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Translation (original attached after translation)

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

CLAIMS

[Claim(s)]

[Claim 1]A method of performing by computer for **** using information about a patient in at least one existing database thru/or condition intervention, comprising:

a) A step which processes patient information in a database based on a predetermined standard that patient information of a patient group about identification **** thru/or condition should be extracted.

b) A suitable phenomenon thru/or the data aggregate for i identification **** thru/or condition, A phenomenon thru/or data which using information acquired in said database defined, was defined as patient information which carried out the ii aforementioned extraction, and was carried out is changed into a file which consists of phenomenon level information, iii) In order to generate a time frame used as material which judges whether a particular part of a phenomenon which carried out the definition should be taken into consideration by future processings, define a time window, iv) processing phenomenon level information using said time window and a set of a variable that a set of a variable as a potential predictor should be identified and v analysis file should be generated -- vi -- it being a function of a subset of a set of said variable, and. A step which defines a predictive model by conducting statistical analyses to an analysis file that a predictive model and a rule which are used for identifying a patient of a dangerous condition which was diagnosed as having identification **** thru/or condition, or is likely to be suffered from identification **** thru/or condition should be generated.

c) A step which applies said predictive model and a rule to phenomenon level information of a set same or new in order to identify a patient in a dangerous condition which is likely to identify a patient in a dangerous condition of identification **** thru/or condition, or is likely to be suffered from identification **** thru/or condition.

d) A step which prepares an intervention list from a patient of a dangerous condition who identified, and chooses intervention at least for a patient of a one dangerous condition, and e. [whether it intervenes to said patient, and] Or a step promoted so that it can give and f. A step which records and pursues an intervention result of a patient of each dangerous condition based on selected intervention according to a request, g) A step which is each intervention result corresponding to said database, and updates historical data in at least one database according to a request, h) A step which repeats said step b(ii), and I. A step which applies said predictive model and a rule again to phenomenon level information extracted from data in an updated database

[Claim 2]A system performed by computer for **** management using information about a patient in at least one existing database, comprising:

a) A processing means to process patient information in a database based on a predetermined standard that patient information of a patient group which has identification **** thru/or condition should be extracted.

b) A phenomenon definition means which using information acquired in said database in a suitable phenomenon thru/or the data aggregate for i identification **** thru/or condition defines.

ii) A conversion method which changes a phenomenon thru/or data which was defined as said extracted patient information and was carried out into a file which consists of phenomenon level information.

iii) A means to define a time window in order to generate a time frame used as material which judges whether a particular part of a phenomenon which carried out the definition should be taken into consideration by future processings, iv) A means to identify a set of a variable as a potential predictor, and a means to process phenomenon level information using said time window and a set of a variable that v analysis file should be generated, vi) A means to conduct statistical analyses to an analysis file that a predictive model and a rule which are used for being a function of a subset of a set of said variable, and identifying a patient diagnosed as having identification **** thru/or condition should be generated.

[Claim 3]It is the method of generating a healthy intervention product from patient information in a computer database, a) A step which uses a computer that patient information of a patient group which has identification **** thru/or condition should be extracted in order to extract and process patient information in a database based on a predetermined standard, b) A step which using information acquired in said database in a suitable phenomenon thru/or the data aggregate for i identification **** thru/or condition defines, ii) A step which changes a phenomenon thru/or data which was defined as said extracted patient information and was carried out into a file which consists of phenomenon level information, iii) A step which defines a time window in order to generate a time frame used as material which judges whether a particular part of a

phenomenon which carried out the definition should be taken into consideration by future processings, iv) a step which inputs a set of a variable as a potential predictor, and v -- with a step which generates an analysis file by processing phenomenon level information using said time window and a set of a variable. vi). Consist of a means to conduct statistical analyses to an analysis file that a predictive model and a rule which are used for being a function of a subset of a set of said variable, and identifying a patient diagnosed as having identification **** thru/or condition should be generated. In a step which programs to a computer a predictive model which consists of a step which defines a predictive model, and a computer, it is c. In order to identify a patient who is in a dangerous condition about identification **** thru/or condition, A step which performs said predictive model and a rule to phenomenon level information of a same or new set, d) A step which outputs an intervention list from a patient of a dangerous condition who identified, and chooses intervention at least for a patient of a one dangerous condition, and e. [whether it intervenes to said patient, and] Or a step promoted so that it can give and f A step which records and pursues an intervention result of a patient of each dangerous condition based on selected intervention according to a request, g) . [whether it is each intervention result corresponding to said database, and kick historical data are updated in at least one database, and] Or a step which generates a new database using said data, h) A step which repeats step b(i), and i A step which performs said predictive model and a rule again to phenomenon level information extracted from data in a database generated at a step (g), j) How to consist of a step which outputs an intervention list which acquired a predictive model and a rule by carrying out SAI hemorrhoids execution to a database generated at a step (g).

[Claim 4]A step which uses a computer that patient information of a patient group which has a identification **** thru/or condition characterized by comprising the following should be extracted in order to extract and process patient information in a database based on a predetermined standard, b) A step which using information acquired in said database in a suitable phenomenon thru/or the data aggregate for i identification **** thru/or condition defines, ii) A step which changes a phenomenon thru/or data which was defined as said extracted patient information and was carried out into a file which consists of phenomenon level information, iii) A step which defines a time window in order to generate a time frame used as material which judges whether a particular part of a phenomenon which carried out the definition should be taken into consideration by future processings, iv) a step which inputs a set of a variable as a potential predictor, and v -- with a step which generates an analysis file by processing phenomenon level information using said time window and a set of a variable. vi). Consist of a means to conduct statistical analyses to an analysis file that a predictive model and a rule which are used for being a function of a subset of a set of said variable, and identifying a patient diagnosed as having identification **** thru/or condition should be generated. A step which programs to a computer a predictive model which consists of a step which defines a predictive model, and a computer.

c) A step which performs said predictive model and a rule to phenomenon level information of a set same or new in order to identify a patient who is in a dangerous condition about identification **** thru/or condition.

d) A step which outputs an intervention list in a hard copy thru/or a form in which machinery reading is possible from a patient of a dangerous condition who identified, and chooses intervention at least for a patient of a one dangerous condition.

e) A step which intervenes to said patient.

f) A step which records and pursues an intervention result of a patient of each dangerous condition based on selected intervention according to a request, g) . [whether it is each intervention result corresponding to said database, and kick historical data are updated in at least one database, and] Or a step which generates a new database using said data, h) A step which repeats step b(i), and i. A step which performs said predictive model and a rule again to phenomenon level information extracted from data in a database generated at a step (g), j) A step which outputs an intervention list which acquired a predictive model and a rule by carrying out SAI hemorrhoids execution to a database generated at a step (g).

[Detailed Description of the Invention]

[0001]

[Field of the Invention]this invention relates to discriminating the patient of a dangerous condition who should carry out from **** and **** intervention management using various electronic data-processing art, if it explains in full detail about the electronic data-processing art in the field of people's health care.

[0002]

[Description of the Prior Art]By devising the program which maximizes compliance with the present medicine safety guideline which also suited the specific desirable method of curing for every case, more effectively, moreover, **** thru/or

condition can be treated so that a cost effect may become large. The therapy of a great portion of **** has changed from episodic symptomatic therapy to **** eradication and **** prevention.

[0003]

[The technical problem which an invention tends to cancel] Generally the cost which the health care takes is soaring, and in most case, since patient care expense requires expense for treating some patients in large numbers rather than other patients, it is not uniformly distributed to all patients. Also selectively, this originates in some patients not undergoing the therapy suitable for the medical condition of the patient concerned. What are not known [that there are some causes in this problem, do not follow the cure with which some patients were prescribed, it does not visit a doctor to timely, or there is a cure more effective than the method of curing currently actually used also as a doctor, and] is included in the cause.

[0004]If a patient is treated with the cure which understands that there is an effect in the state where there is progress condition of ****, the aggregate total cost taken to treat all the patient groups should decrease. If more patients are treated appropriately, the number of examples with which **** progresses to a severe state and the cost of medical treatment becomes high should also decrease.

[0005]

[Means for Solving the Problem]This invention is a system and a method of identifying a patient of a dangerous condition who performs by computer, especially a patient diagnosed as having identification ****, and picking appearance of the information about a patient is carried out to at least one preexisting databases [at least

one]. A system is provided with a means to process patient information in a database based on a predetermined standard so that it may extract information suitable about a group of a patient who has identification **** or is likely to start it. This system builds a predictive model which includes a union rule as follows.

[0006]a) That patient information of a patient group about identification **** thru/or condition should be extracted, Based on a predetermined standard, process patient information in a database, and a suitable phenomenon thru/or the data aggregate for b i identification **** thru/or condition, A phenomenon thru/or data which using information acquired in said database defined, was defined as patient information which carried out the ii aforementioned extraction, and was carried out is changed into a file which consists of phenomenon level information, iii) In order to generate a time frame used as material which judges whether a particular part of a phenomenon which carried out the definition should be taken into consideration by future processings, define a time window, iv) processing phenomenon level information using said time window and a set of a variable that a set of a variable as a potential predictor should be identified and v analysis file should be generated -- vi -- it being a function of a subset of a set of said variable, and. . [whether it was diagnosed that it had identification **** thru/or condition and] or [or / identifying a patient who defines a predictive model and is in a dangerous condition of c identification **** thru/or condition by conducting statistical analyses to an analysis file that a predictive model and a rule which are used for identifying a patient of a dangerous condition which is likely to be suffered from identification **** thru/or condition should be generated] -- or, In order to identify a patient in a dangerous condition which is likely to be suffered from identification **** thru/or condition, Said

predictive model and a rule are applied to phenomenon level information of a same or new set, and it is d. An intervention list is prepared from a patient of a dangerous condition who identified, Intervention is chosen at least for a patient of a one dangerous condition, and it is e. [whether it intervenes to said patient, and] Or promote so that it can give, and based on intervention of which f selection was done, an intervention result of a patient of each dangerous condition is recorded and pursued depending on a request, g) Depending on a request, are each intervention result corresponding to said database, and update historical data in at least one database, It is h after repeating said step b(ii). Said predictive model and a rule are again applied to phenomenon level information extracted from data in an updated database.

[0007]

[Embodiment of the Invention]

The number of the sick patients to whom it is, and it is made, and undergo a suitable therapy in coping with condition, it puts under the therapy concerned, or the therapy concerned is performed can be made to increase within fixed population in the **** managerial system and method by outline this invention. In this invention, it is required to know the desirable therapy method of curing for every stage of progress of condition of disease. This method of curing may be a medicine guideline already exhibited, or may be the guideline which the health-care specialist developed according to various kinds of illnesses. These guidelines are called the medicine safety guideline (Best Practice Guidelines).

[0008]"**** management" The patient who has condition over a long period of time [chronic] which hospital treatment expense becomes big-ticket, invites a high cost,

cannot expect an uptrend, or has a thing risk is identified for example, used for the becoming term in a health-care organization, a medicine group, an employee, or a government support plan. It opts for the **** management service by the area of research about the product development manager who works as a **** management specialist.

[0009]A **** management service is provided to a patient (patient currently involved in the subscription organization of a management care organization (MCO) or others), and it is made in order to improve the result of the future of the **** concerned by intervening when it is in a specific stage with a patient's ****. Information, including the individual clinical recording, a clinical history, a medication record, etc., is acquired, for example from the third party concerning a **** managerial system.

[0010]Although this specification mainly explains the example which used the **** managerial system of this invention in the field of the health care, In that case, the health-care provider who comes out is a main client of a system, and the information about this health-care provider's patient is stored in the database used by operation of this invention. However, as a client, even when it is a user of others which are interested in **** management thru/or regulation of the individual of fixed population, this invention can be applied, for example to an employee, a government agency, an insurance provider, and it. Similarly, the information stored in the database of a **** managerial system is extensible till the place which includes the information on others about an individual in demographic data, social data, geography data, family history, and it.

[0011]The fundamental **** managerial system has considered one **** thru/or condition. However, he subdivides it in single analysis and is trying to send a risk profile by the case of ******** thru/or condition according to a compound factor, ********, or

condition. In such a method, each **** thru/or condition is regarded as a module whose correlation is possible like the field of a relational database. In taking out the risk factor to a specific patient group, by doing in this way, two or more **** thru/or condition can be analyzed.

[0012]In drawing 1, although the figure of the advanced level of the **** managing process by this invention is shown, There, the modeling process 102, a dangerous condition patient's intervention process 103, the **** management modeling guideline sauce 104, intervention, and the medical guideline sauce 105 are shown as a result of [prediction healthy] a patient's disease information source 100. There are two portions, the risk hierarchization 140 and the intervention managing process 160, in the intervention process 103 of the patient of a dangerous condition. Usually a patient's disease information source 100 has a form of the database which includes record, health condition record, mental condition record, a laboratory-test result, gnosia and intelligence test data, a formula, a therapy, etc. of the clinical recording of the patient concerning a health-care provider's program, for example.

[0013]The modeling 102 is the process of generating the statistical model which can be used for predicting whether a certain **** thru/or condition, and health condition of a patient with the clinical recording getting worse on the contrary, as a result of [prediction healthy] drawing 1. A risk hierarchization process 140 of the intervention process 103 of the patient of a dangerous condition being a database analysis process of bringing about the list of large dangerous condition patients of a possibility that health condition will get worse on the contrary, The intervention managing process 160 which

judges whether it should intervene in the health-care treatment of the patient selected in order to decrease the possibility of this healthy aggravation is included.

[0014]Operation of the **** managing process of this invention shown in drawing 1 is explained. First, in a prediction healthy result, the modeling process 102 receives the sample group of patient data from a patient's disease information database 100 about specific ****. Not only it but a prediction healthy result the modeling process 102, In order to generate the predictive model illustrated as the modeling guideline 104 in drawing 1, predetermined statistics thru/or other information are received, and in order to judge the existence of the possibility of healthy aggravation, the specific predictive model of specific **** is generated. Data same thru/or similar although the probability that specific **** thru/or condition of being related to healthy aggravation will arise is judged can also be used.

[0015]The risk hierarchization process 140 receives the predictive model which the modeling process 102 generated in the prediction healthy result, and this predictive model analyzes data peculiar to each patient of the patient disease information database 100, The list of large patients of a possibility that the health condition of the patient suffered from specific **** will get worse is clarified. Thus, if the list of patients becomes clear, the intervention managing process 160 will come to urge him to intervene in a patient's therapy process by contacting a patient thru/or a doctor, and a health-care provider. The external creation information about the specific intervention indicated to be a desirable therapy method of curing for every stage of progress of condition of disease as intervention and the medical guideline 105 in drawing 1 is required for the intervention process 103 of the patient of a dangerous condition.

[0016]Finally, it may record in itself [intervention], and once the intervention process 103 of the patient of a dangerous condition finishes, these intervention results shown as intervention result measured value in drawing 1 will be stored in a patient's medical intelligence database 100. The feedback step which feeds back the data of an intervention word [a whole process] by this, In order to promote analysis of a result, it can become some bases for being made to be carried out again through a risk hierarchization step, or generating a new risk hierarchization process of having corrected.

[0017]A **** managerial system analyzes the flow of health information peculiar to each patient, and avoids that intervene in a doctor thru/or a patient at the time of necessity, and health condition gets worse, therefore he is trying to avoid a high cost phenomenon in short. The following thing is contained in this **** management.

[0018]1) The state of a certain predetermined **** drawn from research data should be based, and identify the potential patient expected to participate in the organization of a client, and a program.

[0019]2) In order to evaluate the state of ****, use the claim on medicine, the claim on dispensing, clinical data, and lab data.

[0020]3) In order to carry out management maintenance of the program, use the intervention measure defined beforehand. As an example of an intervention measure, there are an answer, a temporary transfer according to a health-care specialist further, etc. to dispatch of a periodical notice, dispatch of symptomatic enlightenment material, and the telephone poll from a patient.

[0021]4) Carry out management management of the process with the case (case) program manager which performs a required intervention measure to a client (for example, MCO, a health-care provider), a doctor, and a patient.

[0022]5) In order to judge whether the end of specific **** improves by a positive **** management service, record the intervention in a patient's health care.

[0023]6) In order to judge a result to intervention, process intervention management information [an analysis process].

[0024]If it is in the method of this invention, it is a case program manager (although drawing 1 does not show, about the function of the manager concerned.). it is shown as a part of case managing process 150 which was shown in drawing 2 and which is mentioned later. While clarifying the patient expected to receive a benefit by change of a therapy to a doctor and proposing a cure to a doctor, a patient's therapy is made to progress by taking remedial compliance measures on education to a patient (simultaneously therapy doctor in attendance). What a case program manager diagnoses **** or prescribes a therapy method of curing is not done. The diagnosis and the therapy on medicine are a qualified medical practitioner's duty.

[0025]By using the method of this invention, the case program manager can clarify a patient's subset which is not treated by the important thing in accordance with the desirable therapy method of curing at the state of the patient's **** from the patient who has received the therapy, and it. It is dramatically suitable for this invention, and the therapy method of curing of the patient who has not received the desirable therapy method of curing from this patient group becomes clear automatically, and this patient

group can affect change of a custom, or it can have influence so that it may double with a recommendation therapy method of curing.

[0026]In the explanation after this invention, for convenience a case program manager, A prediction healthy result is shown as single sauce of external information like the modeling guideline 104 for the modeling process 102, and the intervention for the intervention process 103 of the patient of a dangerous condition and a medical guideline.

[0027]Generally, the exclusive computer system automates, for example, and the function of most case program managers is performed. However, when the **** control program was started, or the end user provided external information or corrected to the **** control program based on experience, a new parameter will be provided or he will change the intervention method if needed.

[0028]If it is in the embodiment of the great portion of this invention, the role of the case program manager is divided into two or more persons or substance (entities). For example, the patient who has a possibility of becoming a "high cost" patient, in one "case managed" substance is discerned, Another substance contacts a doctor with a compliance device remedially with this information and not only remedial advice but a patient's teaching materials, and has been the condition referred to as that the third substance moreover carries out direct contact to a doctor. Another substance may identify statistical information and may assume the duty which generates a predictive model. As a result of performing the method of this invention, it was special, and the patient suffered from ****** which moreover needs the care which expense requires is a small number, and was able to receive the therapy with many suitable patients.

[0029]Usually in the method of this invention, at least several therapy medical practitioners are involved. Although about about 100 therapy medical practitioners are involved in the desirable 1 embodiment, it is more effective if 250-500 medical practitioners or many medical practitioners beyond it are involved.

[0030]The advanced flow chart of the **** managerial system of **** managerial system this invention is shown in drawing 2. A **** managerial system consists of the **** management data library system 101 containing the patient data collection integrated process (PatientData Collection and Integration process) 110 and the **** management data base 120 in drawing 2. The information on a phenomenon level is just going to store this. Next, a **** managerial system is provided with the following.

Prediction modeling process 130.

Risk hierarchization process 140.

Intervention managing process 160.

Intervention record pursuit process 170.

[0031]The case managing process 150 receives the intervention record pursuit process 170 to a rule for intervention information from the intervention managing process 160 again. The case manager 150 provides the information which appeared from the outside in the prediction modeling process 130 and the risk hierarchization process 140.

[0032]The **** management data library system 101 consists of the patient data collection integrated process 110 and the **** management data base 120. The patient data collection integrated process 110 prepares appearance to the predetermined format which deletes redundant information and is common by receiving raw patient data from

health-care sauce, and processing the raw patient data concerned. In the first stage, in order to assume the first patient group (initial population of patients), as an information source, it is more nearly required than one or it.

[0033]As a source of raw patient data, as long as it is just going to save a patient's record, they may be a health-care provider, other providers, and a payment person that makes payment to health-care service, for example like a doctor, a hospital, and a chemist's shop. As [include / it was difficult for it to become impossible to be dispersed or to access and to format, and it overlapped, or / these records / inaccurate information] Therefore, as an information source which can access this information easily, it can find out in a specific benefit provider's (benefits provider) health-care claim record document. According to the typical embodiment of this invention, such a health-care claim record document is used.

[0034]The patient data collection integrated process 110 stores the formatted patient information in the **** management data base 120. This **** management data base 120 is just going to store the clinical recording of the patient who uses by this invention, clinical data, and other data.

[0035]The prediction modeling process 130 of this invention generates the predictive model and rule which identify the patient to whom health condition may get worse to the restrictions on **** which has become clear, or statistics, and it using a sample patient database etc. considering the patient group of predetermined identification ****. "Identification ****" used in this specification means **** in which the client is interested like asthma, and depression and hyperemic cardiac insufficiency (CHF).

[0036]The risk hierarchization process 140 which showed in drawing 2 applies the predictive model and rule on statistics to the patient data from the **** management data base 120 corresponding to the patient of the group who chose from the **** management data base 120 based on the predetermined standard. As this predetermined standard, they may be "all the client (MCO) patients" or "all the new employed people", for example. In the risk hierarchization process 140, the subgroup of the patient (at-risk patient) of a dangerous condition is identified, and an intervention list is generated from this subgroup.

[0037]if the intervention managing process 160 sends a letter and enlightenment material to the patient of such a dangerous condition, telephones or carries out the visit to a house -- etc. -- the schedule of intervention to the identification patient raised to the intervention list is stood, or it is performed. Finally, in the intervention record pursuit process 170, the result is saved for record of the performed intervention.

[0038]Operation of the **** managerial system shown in drawing 2 is explained henceforth. First, the predetermined restrictions of specific **** and others which have been problems are become final and conclusive by the case managing process 150. Identification **** and restrictions are supplied to the prediction modeling process 130. This prediction modeling process 130 receives the patient medical data of the subgroup from the **** management data base 120 which meets the predetermined statistics top standard which corresponded to the patient who has identification ****, and was defined from research data. Then, the prediction modeling process 130 generates the predictive model and rule which identify a patient based on the subgroup of said patient medical

data from the patient group of predetermined identification **** in the dangerous condition in which health condition may get worse.

[0039]The risk hierarchization process 140 receives another rule for the predictive model and rule which were outputted from the prediction modeling process 130 from the case managing process 150. a group contained in the **** management data base 120 based on the information supplied from the case managing process 150 -- a patient's medicine clinical information is searched -- the group -- a patient becomes an identification **** patient group of a predetermined client. Then, the subgroup of the patient of an advanced dangerous condition is identified from the identification **** patient group of the predetermined client where health condition gets worse and which has the risk hierarchization process 140 in a dangerous condition [serve] using a predictive model and a rule.

[0040]Identifying the subgroup of an advanced dangerous condition is a subjective act for which an operator opts. It is not pushed forcibly. For example, "an advanced dangerous condition (high-risk)" is decided according to the weight of **** thru/or condition of disease. Or it may run with the resource which may be obtained. Many resources may receive in view of the cost which provides useful intervention. A screening method used as a classic example of an "advanced dangerous condition" when coping with serious human body suffering a calamity, That is, there is a screening method of not treating also when the viability which is not treated when death possibility is large is large, and treating when a survival rate becoming large by intervening, or becoming permanent disability can be eased. There is a method of defining the subgroup of an advanced dangerous condition as consisting of a fixed rate of all the groups based on the

ability to be treated [how many patients] by specific operation as another example. Therefore, if the throughput of a specific system can treat or manage 1000 patients on a specific day, it can be defined as 1000 patients in the total number being the subgroups of an "advanced dangerous condition." Only expense sufficient similarly to intervene useful to 1000 patients as an interposer in six months can be possessed. Therefore, if this definition is followed, these 1000 patients that are in a dangerous condition highly will become an "advanced dangerous condition" subgroup. There is the method of grading a clinical result to 1-5 as another example, considering the useful result considered, and the patient considered that brings about the good result graded by the larger numerical value than 3 or it is made to progress as an "advanced dangerous condition" subgroup in the method. Age, the incidence rate (age-related likelihood of an adverse outcome) of the bad effect by an age exception, an improvement rating (a positive outcome), etc. can be used for defining an "advanced dangerous condition" subgroup. For example, the patient who has the family who experienced estrogen dependence ****** by the woman of menopause can be determined as an advanced dangerous condition patient. Combining these factors with it two and more in generating the algorithm which identifies an "advanced dangerous condition" subgroup to it is also considered.

[0041]although this step is explained as what identifies one "advanced dangerous condition" subgroup, it can resemble intervention to that extent, it can respond to it, and can also take in to analysis of a level part opium poppy lever. Therefore, defining a set of the subgroup which assigned the specific risk degree (risk factor), and being made to intervene to a set of the subgroup selected based on the level with which risk evaluation

differed is also considered rather than defining an advanced dangerous condition subgroup.

[0042]Clarification of a set of an advanced dangerous condition subgroup thru/or a target subgroup will generate the intervention list which the risk hierarchization process 140 ranked the patient and carried out in accordance with the predetermined standard. if send a letter and enlightenment material to the patient of a dangerous condition, or the intervention managing process 160 of this invention telephones or carries out the visit to a house using this intervention list -- etc. -- it being standing the schedule of intervention or performing it, and, It prevents the health condition of the patient concerned getting worse, or improves.

[0043]Although the intervention managing process 160 incorporates the data sent from the **** management data base 120, this data is "client" identification **** patient data, and is standardized by the appearance of the **** management data library. The parameter and rule which identify the specific patient corresponding to the conditions for participating in a **** program are sent to this data supply thru/or a detection process from the case managing process 150. The population taken into consideration by a specific identification **** program in this detection process is obtained.

[0044]Henceforth, each process of the **** managerial system of this invention shown in drawing 2 is explained in full detail.

[0045]In drawing 3, a **** management data library and the data integration **** management data library 101 are explained, referring to the flow chart of a high level which shows raw patient data acquisition, conditioning, and database formation.

The **** management data library 101 consists of the patient data collection integrated process 110, the **** management data base 120, and the research database 250.

[0046]The patient data collection integrated process 110 The cost claim sauce (Reimbursement Claims source) 200 as a data source, The raw patient data conditioning process 210 of "sweeping away (clean-up) away" away raw patient data, It consists of the translation process 220 which changes raw data into predetermined appearance, and the updating patient data process 230 of updating patient information (this information is also called phenomenon level information) by a subsequent phenomenon thru/or intervention.

[0047]In the patient data collection integrated process 110, raw patient data is supplied to a raw patient data conditioning algorithm from the cost claim sauce 200. As an example of the information source for identifying the group of the patient who has received medical science actually, there are large number of people's health-care benefit provider's (benefits provider) clinical record, health-care claim record (health care claim record), etc. The claim to a charge for medicine, a doctor visit, hospital stay, and a laboratory test pays, and is received and processed by calculation of /cost as known well. If it is in the typical embodiment of this invention, this claim information (claim information) is inputted into DB2 thru/or the Sybase (Sybase) database of the computer system (not shown), for example.

[0048]However, this invention is not limited to the cost demand sauce 200 like a graphic display. Data concerning an individual like demographic data at another embodiment of this invention, The **** management data base is built using personal data, family history, geography data, and other data like the history of social data, a life

style, sexual abuse or the childcare abandonment by parents thru/or corporal abuse, the nutriture, etc.

[0049]The method of this invention borrows the help of the electronic database with which it is data about the individual from the cost demand sauce 200, and medical data, demographic data, medication data, diagnostic data, treatment data, etc. can usually be memorized and searched, for example, and is performed. For example, the following medication data is searched from a cost demand.

[0050]a) Amount d [Provider identifier] of patient identifier b prescribed drug c medication Medicinal quantity e Drug administration treatment period f The latest prescribed drug administration day g [0051]These data has a desirable form in which machinery reading is possible, and it is desirable that it can collect now carefully with the prudent record for every patient in the field which can moreover be searched. As for each record, it is desirable to consist of one currently explained in this specification or the field which has described whether case management intervention beyond it was performed. This data is memorized by the computer and can be accessed now using the customized database use software. Such software has not only a search service but a report (display, printing, electronic distribution) function.

[0052]Drawing 4 is a block diagram of a high level showing three information sources suitable for using by this invention. As shown in drawing 2, generally there are three sorts of information sources, the chemist's shop (Rx) claim 202, the doctor (Dr) claim 204, and the hospital (HL) claim 208, in such a provider's claim information. As listed to the block showing claim information, various information is acquired from each claim by a medicine code, a doctor name, diagnosis codes, treatment, various dates, and it

in other suitable information. The greater part of this information is expressed like the medicine code, the treatment code, and the sick code using the code.

[0053]Returning to drawing 3, the raw patient data conditioning machine 210 performs the data custody check (data integrity check) which identifies and processes the claim dismissed or prepared.

[0054]In order to use a database more efficiently, to the database use subalgorithm (not shown) of the raw patient data conditioning algorithm 210. It has a function in which remove redundant input, remove the input about the patient of disqualification, or the record which performed case management intervention within the predetermined period is disregarded.

[0055]Then, the conversion algorithms 220 read a source-data file, and build the **** management data base 240 for the appearance of a predetermined database by patient information. Although Sybase is used in the **** management data base 240 of this invention, other similar database products can also be used.

[0056]Finally, the updating patient data process 230 of drawing 3 takes in intervention management information from the intervention managing process 160 and the intervention record pursuit process 170, and it updates the patient information of the **** management data base 120 so that the intervention information about a member patient may be included.

[0057]The typical embodiment of the translation process 220 is shown in drawing 5 in the form of the detailed flow chart.

[0058]In drawing 3, the file manager 310 checks whether it is suitable for processing, and saves the information about each file in a catalogue database while it

identifies the file which received the patient data file and was inputted. If the file concerned is a thing according to hierarchy (Hierarchical), the file manager 310 will send the file concerned to the file conditioning machine classified by hierarchy, and will read the contents into a flat file. Then, a flat file is saved by the flat file treater 330 at the **** management data base 240 by using the information included on the input environment table 340 and the output ring boundary table 350. Patient data is saved in a database by using a data model after that.

[0059]Drawing 6 shows a typical data model which is used in the patient data library in the 1 embodiment of this invention. The source-data library 410 which records the feature of the data inputted into SAI of database construction on this data model, It consists of the exception-handling process 420 of processing a data exception matter to SAI of a construction process, the client table 430 including the list of **** management provider clients, and the member table 440 containing identification information peculiar to a member.

[0060]The claim table 450 which is record of health-care activities [in / in a data model / the member table 440] of as opposed to [whole member patient] a one member, The lab table 460 showing the substance which is related to collecting the clinical trial data about a specific member, and a relation, and the diagnostic treatment table 470 which are the diagnosis for every specific claim and record of medicine treatment are also included.

[0061]The systematization process of a data model is as follows. In drawing 6, the source-data list 410 records progress and the characteristic of the data inputted into a database construction process. The exception handling 420 processes the exception of

data in a construction process. Lose a value, or a value comes out of the range, or generate an exception by the error of others in data, and when an exception occurs, the exception handling 420, These exceptions are canceled by canceling an error based on the information which throws away data, holds some data, or may be obtained.

[0062]A patient is held in the client table 430 and the list of **** management provider clients which have participated in the system and method of this invention is included in it. Each client in the client table 430 has the patient defined as the member table 440 as a member. In the member table 440, information is included like a member name, a birthday, and sex.

[0063]The claim table 450 is held for each [in the member table 440] member patient of every. Each claim in the claim table 450 is record of the health-care activities to a one member. The data items currently recorded include the family doctor of the information about the day when the claim was taken out or the date, the medicine, and the formula which were canceled, the detailed matter of a medicine inspection, and a member thru/or other doctors and the provided service thru/or treatment, etc.

[0064]The necessary condition of the lab inspection carried out about the member with the specific lab table 460 (requisition), The substance and the relation which are related to access (accession) and solution (resolution) are expressed, and there are a blood test, a glucose inspection, the other inspections based on one analyte, etc. as a data item currently recorded.

[0065]Finally, the diagnostic treatment table 470 is recording the main diagnosis and secondary diagnosis beyond one or it to the specific claim expressed as an ICD-9-CM code. Being able to make diagnosis into a diagnostic group (DRG) collectively, DRG

is one of the diagnostic classifications which 495 which shows the resource consumption which the patient resembled, and a stay pattern has. The diagnostic treatment table 470 is also recording the treatment corresponding to each diagnosis, These treatment may be expressed as the inside HCPCS of the foreign-troubles person CPT code (out-patient CPT codes) and a hospital (inch-hospital HCPCS), or a registration code (proprietarycodes).

[0066]Although the 2nd identification **** characteristic database is generated, this is for supplying the database of identification **** patient data to the prediction modeling process 130. Returning to drawing 3, this database is the research database 250 and is a claim level database in predetermined appearance like an SAS format. Although the identification **** sample patient data used for building the research database 250 shall be supplied from the **** management data base 120 in drawing 3, This invention is not limited to it and the research database 250 may be built from the cost demand sauce 200 by using a suitable conditioning algorithm.

[0067]An example of each research database format of Rx and DR which are contained in a research database, and HL claim is shown in drawing 7. Since the specific service provider by which the claim is carried out has also come out as shown in drawing 7, the claims of the claim 1 to the claim x and suitable information are enumerated. The DB2 database expresses the sauce of the raw data element which needs processing by the raw patient data conditioning algorithm 210. Then, it downloads periodically with data to the research database 250.

[0068]Speaking of the generation statistic forecast modeling of a predictive model, drawing 8 is a flow chart of a high level which shows the sample patient data extraction process and prediction modeling process for identification **** by this

invention. As shown in drawing 8, the prediction modeling process 130, (1) The extraction step 610 of identification **** sample data, and Step 620 which performs (2) quality control operations (option), (3) Step 630 which confirms whether data is effective on statistics, (4) Step 640 which changes the data of a claim level into the data of a phenomenon level, (5) It consists of Step 650 which processes the file of a phenomenon level to an analysis file, and a step which generates an identification **** predictive model and a rule by processing an analysis file using (6) statistical technique.

[0069]In drawing 8, the process of asking for a predictive model is started from extraction of Step 610, i.e., identification **** sample data. In this extraction step 610, if data is changed into an SAS format, sample patient data will be inputted into identification **** from the case managing process 150 from the research database 250 again. In an SAS procedure, process information and the patient of (1) identification **** is extracted (Step 610), (2) Process the information on a claim level to the information on a phenomenon level (Step 640), (3) Generate the analysis file for analysis using a predetermined variable and time frame (Step 650), and a predictive model is generated as a function of the variable most often reflected in correlation with a result in which (4) health condition gets worse (Step 660).

[0070]Considering a statistical viewpoint, the important point which must be taken into consideration in developing a predictive model from a database is sample size. In order to maximize the completeness of a predictive model, effective sample size is an important element and it depends for required sample size on the size of union between variables in quest of a prediction equation. Since it is strange about these unions, all the patients in connection with each plan make it contain from the start.

[0071]In extraction (Step 610) of the patient who has the 1st step, i.e., identification ****, thru/or condition. Various parameters obtained from a case program manager, research sauce, or other health-care specialists are used, It has defined which patient has qualification to original all the members (overall initial universe of patients) of the identification **** patients who should take into consideration.

[0072]for example, in the 1 embodiment of this invention, only the patient who has a claim to the long therapy [it is alike, and continue, and are registered succeeding the benefit provider, and] by depression or antidepressant administration beyond 12 months or it has qualification. Although it is needless to say, this standard is only an example, for example, as it said so in if it must be 18 years old as age, adding that at least the registration for 24 months thru/or six months is enough, it can also change a standard. At the desirable embodiment of this invention, it is identification **** (for example, depression.) in the extraction step 610 of identification **** sample data. The therapy in the medicine used under the therapy of the code for which it was suitable with reference to the incidental documents I, or identification **** (for example, the case of depression antidepressant.) All the claim data of a patient are extracted with the code for which it was suitable with reference to the incidental documents III.

[0073]In the health-care industrial world, various codes are used for claim information that it judges whether is required that the claim of which treatment, a therapy, diagnosis, the medicine, etc. was carried out. In the embodiment of the invention, as shown in the incidental documents I and II, the code is selected. About these codes, the U.S. medicine association's (American Medical Association) "the newest procedure glossary (Physician's Current Procedural Terminology, CPT) for a doctor", Are

just going to be indicated by "the collection (St. Anthony's ICD-9-CM Code Book) of ** Anthony ICD-9-CM codes", and it mentions in this specification as reference about the literature of these two affairs as what shows the sauce of codes and these codes. If it is a code showing treatment, a therapy, diagnosis, medicine, etc., even if it is a code like a throat except this, by this invention, it can use, so that a person skilled in the art may understand well.

[0074]In the data-quality-control step 620, claim adjustment and completeness checking are performed by request after the extraction step 610 shown in drawing 8. this quality control step 620, since it is an option, for example, the patient data of identification **** does not need this step, As a result of the raw patient data conditioning step 210 (drawing 3 and drawing 4), when the original **** management data base 120 has sufficient quality, it can skip this step.

[0075]In the quality control method in Step 620, an intermediate output file including two or more sets of frequency counts (frequency count) for processing is generated from the above-mentioned data set. If it is in an embodiment of the invention, in the case where depression is identification ****, it is generated for examination of the intermediate output file of the following characteristic.

[0076]a) The table showing the count of the member by i sex, the table of the count of the member applicable to ii age group, iii) The frequency count of the specific member in the sex, age group (0-9, 10-19, ...), and time record (Mon.) which include the table of the maximum possible month number from the count of the age group divided by sex, and iv time record, i.e., one month, [0077]b) The number of the members who have the frequency count of the ICD code (incidental documents I) of depression, i.e., at least

one hit, and have each ICD code in incidental documents I-a in what kind of level as the 1st code, [0078]c) The frequency count of an antidepressant (incidental documents II) : the number of the members who have one claim even if small per [in the i incidental documents III] each medicine [0079]d) the ICD code -- medicine -- or both ICD and medicine -- ** -- the number of members with the qualification for receiving treatment, [0080]e) The frequency count of the member of all the claims in each file (HL, DR, Rx) for every member, [0081]f) frequency count of all the kinds in DR (anywhere may be sufficient) and HL file of ICD code (only the first three numerical values of the ICD code are used) the frequency of each - being attached to the top 10, i.e., DR, and HL file at least -- table, [0082]g) The hospitalization frequency count on a calendar. It counts backward from the last moon that obtained the availability or qualification of data, and a month number is calculated. Condition called moon 2 as the moon 1 and the moon before that as the moon when data is finally obtained.

[0083]f) The frequency count of the measure related to depression (the CPT code, incidental documents I-b) [0084]i) Frequency count of all the CPT code (as opposed to the level of the first 3 numerical codes) [0085]The above-mentioned frequency count used for performing preliminary evaluation by facing about data integrity is only an example of ******, includes a useful or useless parameter, or can be changed to delete.

[0086]At another embodiment of this invention, the following frequency count is generated by the case where hyperemic cardiac insufficiency is identification ****.

[0087]A) First, generate the frequency count of the number of a member's time records. Then, in the case of the member who has two or more time records of at least six months, it is judged whether CHF diagnosis was during each time record. As a result, the

time record without CHF diagnosis is excepted and holds only the time record of the last with CHF diagnosis.

[0088]B) All the remaining members' time record judges the total cost called ALL COSTS which the member experienced during all the registration in one case. The whole plan, independently, perfect proc univariate of ALL COSTS bundles up per all the plans, and is taken out. "proc univariate" is the SAS method which generates descriptive statistics (for example, an average, a standard, a bias difference, etc.).

[0089]C) Judge the cost (valve flow coefficient COSTS is called) which is especially a cardiovascular system from judged ALL COSTS. If valve flow coefficient ICD-9 code is contained in the 1st or 2nd position of the claim from DR or HL file in judging, it will be considered that cost is valve flow coefficient COST. regarding it as valve flow coefficient claim, if the claim from Rx file is a thing from the medical class 04000 -- calculation -- it is considered that cost is valve flow coefficient cost. Perfect Pro Univariate about valve flow coefficient COSTS is also independently taken out collectively about all the plans the whole plan.

[0090]D) Judge the cost about the hyperemic cardiac insufficiency called valve flow coefficient COSTS to CHF COSTS. If CHF ICD-9 code is contained in the 1st thru/or the 2nd position of the claim from DR thru/or HL file, it will be considered that cost is CHF COST. Perfect Pro Univariate about CHF COSTS is also independently taken out collectively about all the plans the whole plan.

[0091]About the all the members time record which remains, it computes an all the members period monthly collectively independently for every plan. Though the member was registered only for the day at least at that time, the member concerned

regards it as what was registered into the moon. Therefore, perfect ProUnivariate about a member monthly is also independently taken out collectively about all the plans the whole plan.

[0092]F) Finally in the case of all the patient status code =20 in a residual time record, assign a unique member count. That it is status code =20 means that the patient died or it did not recover.

[0093]To cost calculation, the following guideline is applied in the desirable embodiment of this invention.

[0094]a. It can be considered that the medical services of an inpatient's hospitalization, emergency service, a doctor/outpatient, and others of that are every claim and AMTPAIR+AMTCOPAY+AMTRESERVE+AMTDEDUCT.

b. It can be considered that medicinal cost is AMTPAID+AMTCOPAY. However, as for AMTPAID, an amount paid and AMTCOPAY mean the co-payment amount of money, AMTRESERVE means a deposit, and AMTDEDUCT means deduction, respectively.

[0095]By the embodiment of the invention, the following rule is used for the cost hierarchy.

1. Only the hospitalization for CHF brings forth other phenomena.

2. All the Rx expense, treatment expense, and doctor expense are contained in hospital expense.

3. By the visit to a hospital, cost is set as zero (contained in hospital expense), and Rx phenomenon and a treatment phenomenon occur.

4. The visit phenomenon by another doctor does not arise in the visit to a hospital.

[0096]In carrying out preliminary evaluation about data integrity, although it will repeat, the used above-mentioned information is only a mere example, without deviating from the range of this invention, may include the parameter considered to be useful or useless, or may be changed to remove.

[0097]Since input was not effective using this information, in order not to bend the end product, i.e., a predictive model, the "quality check" is performed about the patient of the first identification ****. An intermediate output file is generated by this processing 620 that maintains data quality, i.e., a quality control operation step, For example, the information extracted by confirming whether there is imbalance or imbalance of the data of others out of which a defect comes to the completeness of a predictive model can be polished up like the thing from a person aged 60 and over in all the claims, and the thing from a male. Step 620 in an embodiment is made to be performed in manual operation, looking at an intermediate output file. However, the thing which is considered by using various thresholds and which receive out of balance and scans a frequency count automatically is also considered.

[0098]Information will be changed into the format of a phenomenon label if the information on a claim level is extracted and polished up in accordance with various predetermined standards that it seems that it is suitable for next processing.

[0099]In drawing 8, the following step is Step 640 which changes the data of a claim level into the data of a phenomenon level. In assigning a time window especially for analysis, in order to give flexibility to processing, two master data files which can generate an analysis file are made using the 2nd above-mentioned step (namely, step 640

which changes the information on a claim level into the information on a phenomenon level).

[0100]In the desirable embodiment of this invention, the master data file 1 is a member level file, (1) A member key, (2) birthdays, (3) sex, the registration date of (4) beginnings. (Namely, the opening day (1/1/92) of a data set thru/or a registration date), (5) registration end date. (Namely, the end date of a data set thru/or the final day of registration), the **** phenomenon identified by (6) beginnings. (For example, formula Japan of the beginning of an antidepressant or hospitalization Japan by hyperemic cardiac insufficiency), (7) A leaving hospital day, the number of records in (8) phenomenon files (main file 2), (9) Only the input mode (namely, i) antidepressant to the data set contains all the data of the static thing (that is, not influenced by time) like both iii antidepressants and depression diagnoses of only ii anti-depression diagnosis.

[0101]The master data file 2 is a phenomenon level file containing the record for every phenomenon and the date of a phenomenon which were ordered by the member, and if it is in this invention, it is expressed with the descending order from the phenomenon-happened day.

[0102]The phenomenon occasionally called episode is a generating matter considered to be suitable for identification **** based on clinical knowledge. If there is knowledge what kind of raw data element is obtained from a claim, a set of a phenomenon, When the phenomenon is based on the combination of each data element or the data element, it can set directly or indirectly from a data element, or can draw from each thru/or a compound data element.

[0103]Drawing 9 shows the typical list and its format of the phenomenon for the main file 2 (phenomenon level file) in the case where identification **** is depression. As shown in drawing 9, the following item is included in the inputted item.

[0104]1. claim b. of a hospital currently identified by the hospitalization a. hospital whereabouts place code in depression -- there is a lapse period from the opening day on the 1st at least.

c. There is ICD9 code.

d. Anywhere is depression ICD9 code.

e. sick sign child (illness indicator) (incidental documents V) 1= -- main illness, 2= suicide, and 3= -- main illness and suicide, and 0= -- in addition to this [0105]2. Emergency room a. in depression There is emergency room visit b. ICD9 code (incidental documents I-a) currently identified by the emergency room whereabouts place code.

[0106]3. Medical practitioner (non-hospital) visit a. in depression There is a medical practitioner's claim b. ICD9 code (incidental documents I-a).

c. Category: Psychiatrist =1, other =0 [0107]4. If it follows on approval of the formula a. SSRI (alternative serotonine ingestion depressant) therapy class 5.51.3.b. hospital of SSRI, it will be cost =0c. Category sign child = blank [0108]5. Formula a. for TCA (3 annular antidepressant) or MAOI (monoamine oxidase depressant) Therapy classes 5.5.1.1 (tertiary amine), 5.5.1.2 (the 2nd amine), and 5.5.1.4 (monoamine oxidase depressant). And if it follows on approval of a 5.5.2b. hospital, it will be cost =0c. The category sign child = therapy class 1= 5.5.1.1, 2= 5.5.1.2, 3= 5.5.1.4, 4= 5.5.2 [0109]6. Other neuroactive agents (from Rx file)

[0110]

7. Measures against depression (from DR or HL file)

Category: The CPT code or ICD treatment 0= psychotherapy It can set to incidental documents I-b which is not listed henceforth. All the CPT and ICD code 1= diagnosis 90801, 90820, 90825, 90830, and 90862 94.0x, 94.1x, 94.21, 99.22, and 94.23 2= shock treatment 890870 and 908712 94.24, 94.26, and 94.27 -- lessons is taken from this item and cost is assigned to the visit or hospitalization of the doctor which treatment generated.

[0111]8. the item in the hospitalization, in addition the item 8 by depression received diagnosis of depression -- or since the treatment for which depression is sometimes benefited from having taken the antidepressant is seemed, although it may go into Caux Hort, carry out to condition other than depression.

a. All the hospitalization which has a lapse period from the opening day on the 1st at least.

b. Sick ICD9 main code (incidental documents V)

c. About a category, it is the above 1 (1= Lord, 2= suicide, 3 = both, 0= in addition to this).

[0112]The count of the items 9-13 is summarizing one month. The date is an accrual date of the beginning of authorization ****. The number of the identification phenomena generated during the moon is packed into a numerical portion.

[0113]9. Emergency room a. by non-depression Doctor (outpatient) visit a. by the emergency room visit 10. non-depression identified in an emergency room Doctor visit.

b. Except the visit accompanied by depression diagnosis (incidental documents I-a).

Namely, the thing which is not in the above 3.

11. medicine 12. given in the formula incidental documents IV of a related medicine -- all the medicine which is not contained in the formula incidental documents III or IV of medicine [in addition to this / (what is not depended on depression)]

[0114]13. The formula by depression (from Dr and HL file)

a. Category sign child 1= large treatment, 2= smallness treatment (see the incidental documents IV)

[0115]Drawing 10 shows the event list for the main file 2 (phenomenon level file) by the embodiment of the invention in the case where hyperemic cardiac insufficiency is identification ****, and the format. The example which the main files 1 and 2 can classify according to this embodiment further using the positive (ground) rule which brings about the count of various phenomena is shown.

[0116]I. Count the claim which has a lapse period from the opening day on the 1st that it is small as a hospitalization phenomenon (using both 1st and 2nd ICD-9 codes) called HOSPITALIZATION. The places (for example, an emergency room, a doctor's administration building, etc.) where service for consideration was offered by the whereabouts place code are distinguished. Cost is put only into a 1st ICD-9 code category. If what is newly hospitalized in the next day which left hospital from the former hospital occurs, it will mediate between two hospitals to one. On the other hand, if what is newly sent to hospital after progress of considerable days occurs after leaving hospital

from a former hospital, it will be considered that the hospitalization to a next hospital is new hospitalization.

[0117]A whereabouts place code II. 07 or 08. Or the claim which is 10. Or A0010-A0070 to which a hospital common treatment code system (Hospital Common Procedure Coding System, HCPCS) sets a provider code to 81, A0215-A0225, and the claim which is A0999, It counts as an emergency room visit phenomenon (using both 1st and 2nd ICD-9 codes) called ER VISIT. Cost is put only into a 1st ICD-9 code category.

[0118]III. Although the whereabouts place code has a peculiar service provision day (DOS) by 01 or 06, Although the claim which accepts a provider key which is different in the same DOS (it will be dealt with with the same office visit if the same DOS has same provider key) is counted as an office visit phenomenon called OFFICEVISIT, An office visit phenomenon (all the costs accompanying this phenomenon shall be attributed to hospitalization) is not taken out with the case where it generates while sending this office visit phenomenon to hospital. The HCPCS code counts the claim which is A0080-A0210 which sets a provider code to 81 as OFFICE VISIT. About other office visit phenomena, cost is put only into a 1st ICD-9 code category. :124 (radiation therapy) between which it mediates with the office visit generated in the same DOS if it was not regarded as another office visit in the case of the following provider key but was, 224, 25 (independent lab), 355 (hosp o/pat lab x-line).

[0119]The definition of the kind of three phenomena mentioned above is further carried out by related diagnosis.

[0120]The next step of drawing 8 is Step 650 which processes the file of a phenomenon level to an analysis file. After generating the two main files using the

above-mentioned command (instructions) corresponding to Step 640, processing using time frame information and the selected variable (subordination and independent variable) is performed to phenomenon level data, and, thereby, an analysis file is generated at Step 650.

[0121]Drawing 11 shows the typical appearance of the analysis file. Like a graphic display, the 1st column of a table has a list of members at the appearance of an analysis file. It is the list of variables which is crossing the crowning of the table, and it mentions this later. In the body part of the table, the data about a member's relation to the enumerated variable is indicated.

[0122]Especially, in the processing to an analysis file from the main file in Step 660, the algorithm with which a part is defined by a time window and two or more variables is used. This algorithm can carry out [reprogram]-izing to compensate for various time window adjustments and variable change. the analysis file generated at this step -- the file (namely, thing which was just made into the member and was systematized) of a member level -- it comes out. The main analysis file is a member level file drawn from the information in the main file.

[0123]Each main analysis file is generated so that one base period window of the phenomenon (censored) of investigating, and the prediction window which is interested in the file concerned may be taken into consideration. Each new time window applied to data has required another main analysis file in the embodiment of the invention.

[0124]In order to generate an analysis file, a time window scheme is applied to phenomenon level data with two or more variables.

[0125]If a variable is discussed first, the independent variable and the dependent variable are contained in processing. The independent variable expresses the potential predictor of aggravation of health condition fundamentally, and the dependent variable expresses fundamentally aggravation of the health condition which should be predicted.

[0126]If there is nothing about identification **** in order to ask for the independent variable as an example for Step 650, the data element of most possible bases will be used. Then, an additional variable is generated based on the clinical knowledge about identification ****. The combination of either of the data elements and variables based on clinical knowledge or both is used as a variable. Finally, some variables are generated and it uses based on those potential usefulness as a turning point (as a leverage point) in **** management.

[0127]In the typical embodiment of this invention, in order to generate the analysis file in the embodiment which makes hyperemic cardiac insufficiency (CHF) identification ****, two or more variables actually used at Step 650 in an SAS routine are shown in Table 1 with each item in a phenomenon file. It is considered automatically that each phenomenon in drawing 10 is an independent variable for processing.

[0128]

Table One Additional independent variable 1. Age (at the time [- One of three] of the first CHF diagnosis or medication)

2. Sex (M/F)

3. HMO membership (specification of specific HMO)

4. The first CHF diagnostic place (whereabouts place code)

5. Ischemic cardiopathy (Y/N)

6. Diabetes mellitus (Y/N)

7. Diagnosis (Y/N) of life style which is not preferred

8. Cardiac arrhythmia (Y/N)

9. Other cardiopathy (Y/N)

[0129]Speaking of an dependent variable, there is a result which should predict use by this invention as a potential dependent variable considered, for example. In the case of CHF, some are following in such a result.

[0130]1. Hospitalization (HL) by CHF. if this is a variable of the bisection called as a HL sign child (HL indicator) and has permission -- HL=1 -- other than this -- coming out -- a sign child -- 0.

[0131]2. High cost. For example, a high cost sign child is good also as a maximum of 10% of the resource capacity factors in a dollar. A resource is analyzed independently - each whole stage counted from the time of the expense in top the 10% of the first CHF diagnosis, or the receiving date+1 of the first CHF relation medicine (on record), and 3 or 6 months. This will also be a variable of the bisection called a High Cost sign child, for example, if there is a patient to top the 10%, it will be High Cost = 1, and by except [its], it is High Cost = 0.

[0132]The high cost sign child can also regard as distribution (PMPM) of the aggregate total cost for every [in a region of prediction (from B to C)] member in an embodiment of the invention. The high cost sign child in the case where PMPM in aggregate total cost distribution is 10% of the No.1 member is 1, and it is 0 by except [its].

[0133]3. Death [0134]Although only three dependent variables were mentioned about the specific example, it is just going to be understood easily that the known or the strange variable of others which suited the purpose of this invention can be used within the limits of this invention by the person skilled in the art so that it may be known well.

[0135]Speaking of the time window about generation of an analysis file, lessons is taken from each selected story member, and only one analysis record is.

[0136]In this invention, in order to generate an analysis file, the below-mentioned scheme which defines a region of prediction and investigation data (censoring data) is developed. That is, in drawing 12, the phenomenon window (analytical region) 912 where activity (activity) is used for a time window predicting somethings in this prediction zone fundamentally to be a prediction zone thru/or the field 910 is defined. It is clear to a person skilled in the art that another time window scheme can be suitably used in this invention so that clearly.

[0137]Time for a claim history to cover will be called the time window which begins from a somewhere "A" point and is ended at the "C" point on account of explanation. This time interval is divided with the "B" point which has a relation of A<B<=C in analysis and a region of prediction. That is, "B" will express the present, "A" will express a former phenomenon, and "C" will express a previous phenomenon more far.

[0138]For example, it is assumed that Jane Doe's analysis record is based on the claims from January 1, 1991 to June 30, 1993. In this case, it is A=1/1/91, and C=6/30/93, and B may be chosen as 13/31/02 between somewhere with both days, for example. generally, A is defined based on the date extraction protocol from the time of

data being obtained namely,, and is defined in the final day which the member is still registered about C and has the qualification to be a recipient of a benefit. Needless to say, in carrying out this invention, the method of definitions other than this can also be chosen suitably.

[0139]The definition of this time B is important. If it is in this invention, in order to maximize the accuracy of a predictive model, two fundamental definitions are provided about B. Although another definition about B can also be used for a person skilled in the art so that he can understand.

[0140]Drawing 13 calls the scheme 1 and the typical time window scheme which is used in processing data from the phenomenon level file shown in drawing 8 is shown.

[0141]In the scheme 1, it is considered as B=C- (x# KA moon) to all the members in analysis by applying to C from B and setting up a phenomenon region of prediction. For example, when building a CHF hospitalization (HL) model (that is, HL is used as an dependent variable) for six months, it is B=C- (six months). In Jane Doe's example, B will be equal to 12/31/92. Therefore, CHF [/ in "the following six months"] is predicted only using the date which covers (1/1/91-12/31/92) from A to B. The time B is a "these days point" and the "following six months" said here is carrying out the implication of being in the future at the time of after that, and having been at the previous time in the past. This is a keynote concept of the scheme 1, and it is important when you understand operation and employment of a predictive model.

[0142]The analysis (reflectproximity to the event) dignity which reflects the appearance of the phenomenon which should be predicted as another embodiment of this invention, For example, it can also use less than three months as x1, 3-6 month x.75, 6-9

month x.5, 9-12 month x.25, and more than 12 month x.125. For example, it is known by the person skilled in the art, other suitable weighting methods can also be used like negative weighting. For example, the actually used dignity factors are 1/e-x, and x here is attached for every phenomenon and expresses the time (Mon.) from the point in time B with the typical embodiment of this invention.

[0143]So, if a suitable set of a time window scheme and a predetermined variable is given, an analysis file will be generated at the processing step 650.

[0144]If it returns to drawing 8 and an analysis file is generated in Step 650, in the following step 660, Step 660 which processes an analysis file using a statistical data will be performed, and an identification **** predictive model will be obtained now.

[0145]If an analysis file is used, various discernment thru/or a predictive model can be built by using statistical technique. The analysis file which is in a member's level especially is processed using the statistical function obtained in SAS.In the typical embodiment of this invention, the statistical work performed in order to generate a predictive model is symbolic logic multiplex revolution (multiple logistic regression). If it is in this invention so that I may be understood by the person skilled in the art, other statistical techniques can also be used.

[0146]In a typical embodiment, if statistical processing is applied to an analysis file, the variable by which the importance (probability value <0.05) of a predetermined level is fulfilled by the processing concerned will distinguish. These variables are the arithmetic expression Logit (p). = a+bx1+cx2 .... The predictive model expressed with +zxi (however, a variable and a to z which x1 to xi distinguished expresses the rough

value of these parameters) is built. Then, each certainty (p) under consideration about a result is a formula. It asks by using p = e-logit(p) /(1+e-logit (p)).

[0147]Some experiments were conducted using the above-mentioned step. In one certain experiment, HL sign child was made into the dependent variable, and the result of the model based on the scheme 1 of (with all commercial members) was searched for about all the members. The independent variable which is most often likely to predict the healthy aggravation by obtained CHF, (1) They were the hospitalization-length of stay in hospitalization by CHF, a (2) loop-diuretic-daily dose (days supply), and (3) hypertension, the doctor visit by CHF and the doctor visit by (4)(5) MI, and the amount (possession) of (6) ACE depressant possession (negative sign child).

[0148]In another experiment, HL sign child was made into the dependent variable, and the result of the model based on the scheme 1 about all the members who have not been before sent to hospital in CHF was searched for. The independent variable which is most often likely to predict the healthy aggravation by obtained CHF, (1) A loop diuretic-daily dose (days supply), the doctor visit by (2) CHF, (3) Hospitalization by IHD, the doctor visit by IHD, the visit to an emergency room of (4) (5) diabetes mellitus, (6) the visit to an emergency room by the hospitalization-length of stay in hypertension, and (7) lifestyles, hospitalization by (8) and other cardiopathy, a doctor visit in the state of (9) lungs, the doctor visit by (10) ischemia or the visit to an emergency room by ischemia, and (11) -- "in addition to this" -- it was the formula (Rx) of valve flow coefficient medicine.

[0149]In another experiment, HL sign child was made into the dependent variable, and the result of the model based on the scheme 1 about the Medicaid member

was searched for. The independent variables which are most often likely to predict the healthy aggravation by obtained CHF were hospitalization by (1) CHF, a (2) loop-diuretic-daily dose (days supply), and hospitalization by CHF and a doctor visit of (3) (4) diabetes mellitus.

[0150]Although the scheme 2 as what is replaced with the scheme 1 is shown in drawing 14, the second typical time window scheme used when processing data from the file of the phenomenon level generated by this invention here is shown.

[0151]The point of difference between the scheme 1 and the scheme 2 is at the point that the definitions of a region of prediction to the member who has the hospitalization by at least one identification **** thru/or the visit (HL/ER) to an emergency room differ. Since the point in time B, the region of prediction in the starting scheme 2 carried out the plural passes of each member's record, and has defined it. applying to the analysis record (1/1/92 to 6/30/93, A=1/1/91, C=6/30/93) in above-mentioned Jane Doe's example -- a time -- B -- setting -- hitting -- the scheme 2 -- how -- working -- or -- explaining -- although. In that case, Jane Doe assumes by depression that it is 3 times, i.e., the thing hospitalized in 4/1/91, 4/1/92, and 4/1/93.

[0152]a time -- B -- the first identification **** HL/ER-it is set up in the case where there is no identification **** HL/ER in the date for one month, or a member's claim history become equal to the time C. In Jane Doe's case, it is B=4/1/91. If it is in the typical embodiment of this invention, it is made to go back for one month from HL day, but it is because this imitates the environment where a model is used. A possibility that there is delay on the 30th at least from the scoring (scoring) of a model to a **** administrative action based on a mark report (scoring report) can be considered. It is set

to B=4/1 / 91-(one month) =2/28/91 in Jane Doe's example. In this case, since the time interval of an analytical region does not spread record of Jane who comes out only for two months, i.e., it is shorter than six months usually needed for the data history, it cannot be used for modern construction.

[0153]repeating Step 1 and Step 2 using the following HL date (or the third time thru/or it or later) -- a time -- B -- setting up -- if -- Jane Doe -- record will be included in modern construction with a two-times eye and the third path. According to the typical embodiment of this invention, since those to whom this process has identification **** beyond five or it in for research are considered that it cannot be, they end with 3 times thru/or four paths.

[0154]As a result of repeating modeling, the troublesomeness which sets up an independent variable independently will increase. However, the important advantage of the scheme 2 is in the place where the rate of prediction HL/ER is larger than the scheme 1.

[0155]The analysis (reflect proximity to the event) dignity which reflects the appearance of the phenomenon which should be predicted in another embodiment, For example, it can also use less than three months as x1, 3-6 month x.75, 6-9 month x.5, 9-12 month x.25, and more than 12 month x.125. The other suitable weighting methods known by the person skilled in the art can also be used. Any of the scheme 1 or the scheme 2 can use such a weighting method.

[0156]In the result of each experiment, it is shown that a number of independent variables which are different in a specific predictive model can be used, and the independent variable more than it or not more than it can be used based on each

capability to predict the selected dependent variable correctly according to the accuracy of a desired model.

[0157]Generation, next the predictive model for which it asked of risk hierarchization and an intervention list are applied to data peculiar to a client. The model for which it asked is applicable to the existing data, the data updated periodically, or the claim database of others of other benefit providers. For that purpose, only the called-for interested independent variable should be processed. Although it is needless to say, in order to judge whether other variables can become a better predictor as a new claim database is analyzed, all the processes are repeated and a new model is generated.

[0158]The output generated by applying a model is a file including the list of all the patients who have identification **** which the sign child (namely, experience defined with the dependent variable) showing the sign in which a patient's health condition may get worse shows. The possibility of health condition aggravation may become large every [5% or] 10%, or this list may be subgroup-ized according to the increment of possibility.

[0159]The performance of a model can be evaluated now by asking for the number of indication (actual adverse health outcomes) of the possibility of the actual healthy aggravation generated in the prediction window for every increment subgroup 5% each thru/or 10%.

[0160]By applying a model to an identification **** patient's database thru/or future claim data, or building a new model in a new database, as mentioned above, Since a patient with the large possibility of identification **** can be identified, the effective assignment of a health-care resource to the patient concerned can be maximized by

performing various intervention. The risk hierarchization (RS) process 140 is required in order to generate the list of such patients, and the intervention managing process 160 incorporates these lists, and makes intervention start to the patient of identification ****. These processes are explained in full detail henceforth. the new intervention based on [one] the characteristic of specific case management and two subgroups in such intervention, 3 high-risk intervention, 4 (relative) high-cost intervention, and 5 -- which form of a planned [to follow a medicine safety guideline needless to say] improvement may be taken [0161]In drawing 2, the risk hierarchization (RS) process 140 needs to support the **** managerial system by supplying the list of patients who have the possibility of healthy aggravation in the intervention managing process 160 by identification ****. The list of persons is called an intervention list in the meantime.

[0162]The high-level flow chart of a risk hierarchization process 140 of consisting of RS front end 1110 module, RS mining engine (mining engine) (ME) 1112 module, and the RS database 1118 is shown in drawing 15. These two modules collaborate and output an intervention list from the RS database 1118.

[0163]The RS front end (FE) 1110 acts as an end user, and can be made to perform the input of information required to run a patient's **** program or maintain.

[0164]The RS front end 1110 of this invention is written using Delphoi 2.0 which is a 32-bit software development tool. This RS front end 1110 stores the parameter of a patient and **** in the Sybase (Sybase) system which runs on Windows NT or a UNIX server. this RS front end 1110 -- Borland 32-bit Sybase SQL -- a link -- the database driver is used. However, since this invention can also be carried out using other similar development and database tools, it is not limited to the above-mentioned tool.

[0165]RS mining engine 1112 runs the assigned client (scheduled) identification **** program, and generates the intervention list supplied to the intervention managing process 160 of drawing 2. This RS mining engine 1112 is the batch thru/or the Daemon process of having the following fundamental program logic.

[0166]A. It rises as an every night (batch) or Daemon process.

B. Judge a client identification **** program required to run based on a schedule and available data.

C. Gain a **** program rule component about the client **** program planned.

b) Gain a **** programme parameter for every rule component.

c) Validate that there is a data stream (Rx, Mx, and lab) required for an identification condition program.

d) Initialize the client identification **** program planned.

e) Execute the client identification **** program planned.

f) Supply an intervention list to the intervention managing process 160.

D. Set it as an end (batch) or sleep (Daemon).

[0167]RS mining engine 1112 is written using Delphoi 2.0 which is a 32-bit software development tool. this RS mining engine 1112 -- the lab examination report and ****** for the RS front end 1110 to a client chemist's shop claim, a medicine claim, and a specific **** program, although the taken-out **** parameter is processed and a specific intervention list is outputted, All the list of these is searched from a relational database, or is memorized. Sybase system 11 database which runs on Windows NT or a UNIX server is used for RS mining engine 1112. moreover -- this RS mining engine 1112 -- Borland 32-bit Sybase SQL -- a link -- the database driver is used.However, since this

invention can also be carried out using other similar development and database tools, it is not limited to the above-mentioned tool.

[0168]Operation of the risk hierarchization process which showed in drawing 15 is explained in full detail. The end user who cooperates with the case managing process 150 of drawing 2 or another substance inputs end-user identification **** program information into the RS front end 1110 first. Then, the information for the setup of identification **** with new RS front end, A new **** program, a predictive model and a rule, client specific parameters, To a **** specific rule parameter and it, a new client is memorized, and this RS front end 1110 unites a **** program to a client and a schedule **** program, and runs an information report. The RS front end 1110 memorizes this information as a "**** program" in the format which RS mining engine 1112 uses.

[0169]Although a **** program is supplied to the RS database 1118 by the RS front end 1110, a predictive model and rule information are also incorporated into this RS database 1118 from the prediction modeling process 130. Finally, if RS mining engine 1112 applies a predictive model to patient data, patient medical intelligence will be supplied to the RS database 1118 for RS mining engine 1112 from the **** management data base 120. Finally, RS mining engine 112 incorporates the information included in the RS database 1118 as RS mining engine executes a **** program and applies a predictive model to patient data.

[0170]Drawing 16 is a flow chart of a high level which shows RS mining engine 1112 of the risk hierarchization process of this invention. RS mining engine 1112 shown in drawing 16 comprises three important subsystems, RS schedule manager (SM) 1210, RS rule manager (RM) 1214, and RS intervention list manager (ILM) 1216. . Each

subsystem may be a subset of the **** management data base 120 of drawing 2. It acts mutually with the RS database 1118 containing a client and identification **** program-analysis environment (client and identified disease program analytic configurations), and suits.

[0171]The **** management data base 120 is periodically updated by the patient information (a member, qualification, a chemist's shop (Rx) claim, a medicine (Mx) claim, a clinical lab (Lab) claim) for every client. Therefore, the RS database 1118 is also periodically updated by a client and client membership information. RS mining engine 1112 is collecting the suitable client patient information which should be processed with a **** program-analysis rule from the **** management data base 120. In the typical embodiment of this invention, all the relational databases are the Sybase systems 11.

[0172]In order to check whether the list of RS schedule manager 1210 identification **** programs was compiled, and the schedule time which executes a program has reached, it performs by investigating each registration client. A client **** program precedes being schedule-ized and must be accepted in preparation for execution with RS mining engine 1112. In recognizing in this way, it is necessary to clarify that it is in the state where the RS front end 1110 comes into effect, and the data inputted into that all the **** programme parameters are inputted and it can process with RS mining engine 1112. Finally, it checks that all the data streams that RS schedule manager 1210 needs are obtained. As RS mining engine 1112, it may be a batch program executed periodically. It is chosen by the above-mentioned logic and RS rule manager object is generated for every identification **** program. Sequential execution of the RS rule manager object is carried out.

[0173]Then, RS rule manager 1216 builds a rule required at least in order to perform by the sequence (ordered sequence) which set in order and carried out the specific identification **** program. It is taken out by the prediction modeling process 130 and the case manager 150 although these rules are explained in full detail like Ushiro. Each rule object is initialized by the **** program and a client characteristic rule argument. It is desirable to include the sequence of the common rule beyond one or it and the rule beyond one called a patient group classification child (PGC) or it as a rule sequence. PGC is used for laminating the client patient group (targeted client patient population) aimed at in the specific group in order to intervene thru/or report based on a specific standard. A patient membership [/ more than any one or it of the condition program PGC] is based, and all the intervention and reports are carried out.

[0174]A common rule is performed in a specific order in advance of PGC. Generally these rules. [whether the environment for other rules (a client intervention, Rx claim, Mx claim, etc.) is prepared with a rule, and] Or since the exclusion operation which precedes acting by other compound rules (patient survival (Patient Active), patient age, patient sex, etc.), decreases the whole patient set capacity, and raises the whole performance is performed, the common rule has been called. The patient "contrary to" a specific rule is excluded from a patient set.

[0175]Parallel execution of the PGC is carried out to the rule in each PGC by which parallel processing is carried out to the patient set provided by a common rule. A PGC rule shows whether the patient passed along the specific rule using the numerals counting mechanism (tally mechanism) to each patient in a set, or it swerved.

[0176]After all the PGC(s) are completed, RS intervention list manager 1216 takes each patient's score for the membership in each PGC. Then, RS intervention list manager 1216 generates and saves the intervention list of [for processing], back [in the intervention managing process 160].

[0177]RS schedule manager 1210 -- first -- the time of starting of a batch process -- or, When performing as Daemon, the RS database 1118 is accessed periodically, . [whether the date of scheduled execution of the recognized client identification **** program (approved client identified disease programs scheduled run date) reached, and] It is judged whether all the required client data streams are updated. If all the required data streams are obtained, a rule manager (RM) object will be generated for every **** program with each client.

[0178]The identification **** program attribute is saved on the table. One attribute is approval status. It is desirable to be recognized before each identification **** program is preferably included in a schedule. If a certain identification **** program is planned, recognition of the **** program concerned will not become invalid.

[0179]Although that judgment which should execute which program when has the other parameter, it is performed via the schedule table containing status and the date of scheduled execution also in it.

[0180]RS rule manager 1214 executes a single **** program, and is bearing the role to manage.

[0181]The group division of the rule is carried out according to the patient group classification child (PGC) assigned to it. every where a common rule (thing without

PGC) is performed in the first place and which is in a **** program after that -- PGC is performed.

[0182]RS intervention list manager 1216 evaluates each client **** program currently executed successfully, and edits making a list in a member's intervention candidate table with the program concerned selected as a thing belonging to each PGC within the program.

[0183]If the member is not deleted from the set by which common rule, the member concerned is included in PGC and his output of a member to each PGC rule corresponds with a desired value (a non-denying rule 1 and a negative rule 0) in this way.

[0184]An intervention list is put into the member contained in PGC on an intervention table. In this table, the selected member's identification information, program execution, PGC in which the member is contained, and the medical practitioner identified when a medical practitioner identification rule is used are contained.

[0185]Rule - The rule classified as a general classification "basis rule (Root Rule)" expresses the rule which needs to be performed in advance of other rules of all the, and initializes the environment in accumulating in other rules of all the. Each identification **** program needs to have only one basis rule. Actually, only this one basis rule is a client intervention (Client Participation).

[0186]The rule classified as a "common rule" expresses the rule which may be performed in advance of PGC. The member "fell and fell" (fail) from the common rule is excluded from a patient set. A rule may be simultaneously performed as a common rule and a PGC rule.

[0187]The rule classified as a "PGC rule" expresses the rule by which parallel execution may be carried out after a common rule. The member "passed" (pass) the PGC rule is marked on the column added especially for the rule in a table. A rule may be simultaneously performed as a common rule and a PGC rule.

[0188]"chemist's shop claim generation (Creates Pharmacy Claims)" -- a rule generates the table for a chemist's shop claim. As for each identification **** program which uses a chemist's shop claim for a data source, it is desirable to have a rule which can carry out this function in advance of the rule which uses a chemist's shop claim.

[0189]"medicine claim generation (Creates Medical Claims)" -- a rule generates the table for a medicine claim. As for each identification **** program using a medicine claim, it is desirable to have a rule which can carry out this function in advance of the rule which uses a medicine claim.

[0190]"clinical laboratory test data generation (Creates Clinical Test Data)" -- a rule generates the table for clinical laboratory test data. As for each **** program using a lab claim, it is desirable to have a rule which can carry out this function in advance of the rule which uses a lab claim.

[0191]"special use (Use Specialties)" -- a rule uses a doctor's technical information.

[0192]"chemist's shop claim use (Uses Pharmacy Claims)" -- a rule uses a table including chemist's shop claim information.

[0193]"medicine claim use (Uses Medical Claims)" -- a rule uses a table including medicine claim information.

[0194]"clinical laboratory test data use (Uses Clinical Test Data)" -- a rule uses a table including clinical laboratory test information.

[0195]All the rule objects in RS mining engine 1112 are going down the common ancestor who brings about a certain basic function structure which all the rules share.

[0196]Rule - The embodiment here of a selection rule and the intervention rule RS mining engine 1112 is supporting various selections and an intervention rule.

[0197]1) The identifier to which a client intervention rule (Client Participation Rule) patient expresses whether you are a member of the group registered into the **** control program. With this rule, it clarifies that all the patients taken into consideration by the following rule are the members of the group to whom a client is wanting to participate in the program concerned. With this rule, it can check that a **** program functions appropriately, considering a patient's benefit structure (benefit structure). A client intervention is the only basis rule at present. Therefore, it is desirable that it is the first rule in a **** program. This is always performed as a common rule.

[0198]2) Rx claim rule (Rx Claim Rule) -- choose all the chemist's shop claim data which can be applied to execution of a single identification **** program with this rule. The chemist's shop formula claim selected for within the limit [specific / analytical time] and specific medicine group is defined. Rx claim rule is always a common rule. Usually, it is [only performing once by the given program, and].

[0199]3) a specific medicine's existence rule (Existence of a Specific Drug Rule) -- this rule identifies a member by the claim of at least one medicine in the specific medicine group within the time frame of a rule. This rule can be performed by any of a common rule and a PGC rule.

[0200]4) a recurrence patient rule (Recurrent Patient Rule) -- identify whether this rule has a medication pattern which a patient shows the possibility of compound independent episode (recurrent) about ****. The patient who has the discrete episode of a specific medicine therapy partly at least with this rule is chosen. This rule can be performed by any of a common rule and a PGC rule.

[0201]5) the present cure stop rule (Stoppage in Current Therapy Rule) -- this rule identifies the patient who should suspend the medicine therapy to a specific medicine group. This is judged based on the last formula of the medicine in the medicine group. This rule can be performed by any of a common rule and a PGC rule.

[0202]6) a patient age rule (Patient Age Rule) -- this rule identifies the patient of the age applicable to specific target within the limits. This rule can be performed by any of a common rule and a PGC rule.

[0203]7) the minimum patient qualification rule (Minimum Patient Eligibility Rule) -- identify whether this rule has the qualification for continuing during the continuation specific to a patient and receiving medicine thru/or a medication benefit. This rule can be performed by any of a common rule and a PGC rule.

[0204]8) a patient survival rule (Patient Active Rule) -- prove that the group in whom the member is alive and who there should be and should make it contain in a program at the time of intervention has this rule. This rule can be performed by any of a common rule and a PGC rule.

[0205]9) an average puff equivalent rule (Average Puff Equivalence Rule) -- this rule identifies whether the member has the necessary average puff equivalent of a

medicine therapy between specific time frames. This rule can be performed by any of a common rule and a PGC rule.

[0206]10) -- the number-of-times rule of an occurrence (Count of Occurrences Rule) -- it is identified whether this rule had an occurrence of a selection range on a regulation day (filled dates) which is different about a specific medicine therapy to a patient. This rule can be performed by any of a common rule and a PGC rule.

[0207]11) a patient sex rule (Patient Gender Rule) -- identify the member according to specificity with this rule. This rule can be performed by any of a common rule and a PGC rule.

[0208]12) a dose repetition rule (Dose Level Recurrence Rule) -- identify whether this rule has a medication pattern in the specific dose range which shows the possibility of the compound independent episode (recurrent) about **** of identical or similar weight. The patient who has the discrete episode of a specific medicine therapy partly at least with this rule is chosen. This rule can be performed by any of a common rule and a PGC rule.

[0209]13) the rule (Continuous Therapy at RequiredDoseLevel Rule) of a continuation therapy with a necessary dose -- this rule identifies the patient who continued in the specific period and is undergoing the continuation medicine therapy in the specific dose range. This rule can be performed by any of a common rule and a PGC rule.

[0210]14) a combined treatment rule (Concurrent Therapy Rule) -- this rule identifies the patient who is undergoing the therapy which continued and overlapped with

the prescribed period at least about the specific medicine group. This rule can be performed by any of a common rule and a PGC rule.

[0211]15) a dose rule (Dose Level Rule) -- this rule identifies the patient who has Rx claim of a specific medicine therapy in the specific dose range. This rule can be performed by any of a common rule and a PGC rule.

[0212]16) the amount rule of the medicine used (Drug Usage Level Rule) -- this rule identifies the member who has the amount of the medicine used to an expected value (expected values) in a prescribed range. This rule can be performed by any of a common rule and a PGC rule.

[0213]17) the load existence rule (Weighted Existence of Specific Drug Rule) of specific medicine -- this rule identifies the member who has a medicine therapy in the risk mark range of appointed. In assigning risk mark to each medicine therapy and distinguishing a patient's accumulation risk mark, a member's patient medication record is evaluated. This rule can be performed by any of a common rule and a PGC rule.

[0214]18) a doctor identification rule (Physician Identification Rule) -- this rule should intervene -- choose the specific formula maker (prescriber) who recognizes and sends the connection about a member. This selection is due to either of the chemist's shop claim to that member, and the information about a member's family doctor found out from the member data in the patient data library 120, or both. This rule can be performed by any of a common rule and a PGC rule.

[0215]19) An all the members rule (All Member Rule) all the members rule chooses all the members in a record set. It is used for supporting PGC including all the members selected with the common rule. This rule is used inside with RS mining engine

1112, in order to support optimization of a certain kind of **** program. This rule can be performed by any of a common rule and a PGC rule.

[0216]A list which is used by the desirable embodiment of this invention and the description of the selection rule are contained in incidental documents VI. These rules are easy to change to a person skilled in the art, to delete, or to newly because of specific operation of this invention add.

[0217]an intervention managing process is also acquired and it returns to drawing 2 once, and the risk hierarchization process 140 outputs an intervention list to the intervention managing process 160, in order to carry out specific intervention. Intervention includes sending of the first proposal to the member patient currently raised to the intervention list, full implementation of a **** program, and teaching materials, an extension or outside line telephonic communications, fax communication, E-mail communication, audio response communication, etc. Intervention is recorded in order to judge whether the result of specific **** can be raised by intervention information being sent to the intervention record pursuit process 170, then performing a **** management service by the intervention managing process 160.

[0218]Drawing 17 is a figure of a high level of the intervention managing process 160 of this invention, and the intervention process called an intervention program is carried out based on the intervention list of client members who have identification ****. In the intervention managing process 160 shown in drawing 17. The program execution 1310 which starts an intervention program, the registration 1320 which registers an identification patient into an intervention program, the intervention 1330 which performs

intervention to a registration patient, and the analysis 1340 which analyzes the result of the intervention to a patient are included.

[0219]An intervention list is supplied for data to the intervention managing process 160 from the risk hierarchization process 140 from the **** management data base 120 again. This data supply thru/or a detection process are equipped with the parameter which identifies the specific patient who fulfilled the conditions which participate in a **** program. The population (population) taken into consideration in a specific **** program in this detection process on condition of the following is obtained.

[0220]1) The **** management data base 120 offers the identification **** patient data in which the client was updated by the intervention managerial system as planned.

[0221]2) The intervention record pursuit process 170 returns intervention contact data to the **** management data base 120. This intervention data is saved there in preparation for use in an analysis process.

[0222]3) The intervention managing process 160 detects and chooses change of diagnosis of the new intervention data based on "the addition ("add")" recognized as a new registrant, and **** detection and after that, or each registration request of an intervention manager, and pass.

[0223]4) The intervention record pursuit process 17 incorporates the patient data about people before chosen for the program. It is individual, or data correction is made when change arises in medical data. For example, medical independently, a chemist's shop claim is incorporated, or another lab report is secured.

[0224]In drawing 17, the step of the beginning of a process is the program execution step 1310. This program execution is a process which a **** program is carried out by the process of choosing a patient group in accordance with the standard established beforehand, and is provided with the first intervention. Specific predetermined program activity is performed with selection.

[0225]The following thing can be considered as contents of execution as an example. 1) The letter which tells the action etc. which a doctor recommends to that the patient was included in the program, a **** protocol, and it is sent to the doctor concerned instead of a patient. 2) Intervention management data is passed and loaded to an intervention managerial system by 160 from the **** management data base 120. 3) The first "the contact segment (contact segment)" showing the doctor's letter having been sent is added for a patient.

[0226]The following thing can be considered as contents of execution as another example. 1) The letter of the doctor who tells having been included in the **** program is sent to a patient, and the copy is sent also to a doctor. 2) It is requested that a patient should answer a specific question via an audio response system. 3) Contact is added and an answer is analyzed in preparation for future processing.

[0227]The next step of a process is the recording step 1320. A patient is registered into a program in this step. A patient is registered into a **** management service via an interface with an intervention managerial system. These interfaces may be audio response systems, or may be a reply by a document, and a call directly. In a registration process, schedule **** of the intervention phenomenon in an intervention managerial system begins.

[0228]The following step is the intervention process 1330, and this, 1) By guaranteeing compliance with a therapy course, providing two patients and a doctor with **** teaching materials, extending emergency assistance from three distant places, and filling in a diary by considering 3 each intervention as "contact." It is considered as the judgment material of the validity of a program, and is a process mediated to a doctor and a client for the purpose of establishing the framework which performs middle adjustment to a program, and returning data to a product manager about the validity of four programs.

[0229]The last step is the analysis process 1340, and in order to judge whether the **** management service was successful, it assimilates **** information. Although it does not carry out that an intervention managerial system takes out analyzed reporting, very serious (critical) information is returned to the **** management data base 120 in preparation for processing in the midst of this process.

[0230]Although this invention was explained in full detail about the embodiment typical so far, this invention gives change included in an attached claim, and may be carried out.

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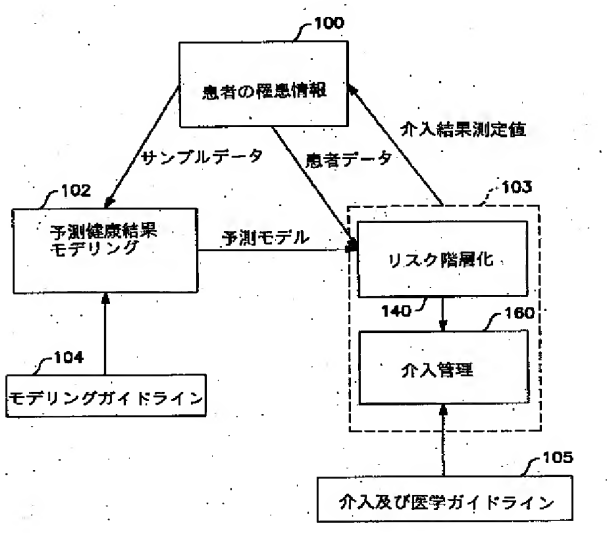
(54)【発明の名称】　病症管理方法とシステム

(57)【要約】

【課題】　人の健康管理の分野での電子演算処理技術を利用して病症と病症介入管理と実施すべき危険状態の患者を識別する。

【解決手段】　コンピュータにて実行する、同定病症を有するものと診断された患者を識別するシステムと方法。患者に関する情報を少なくとも一つの既存データベースから取り出し、同定病症を有するか、又は、それにかかりそうな患者のグループについて適切な情報を抽出するべく、所定の基準に基づいてデータベースにおける患者情報を処理する手段を備えている。このシステムでは連合ルールを含む予測モデルを構築する。



【特許請求の範囲】
【請求項１】　少なくとも一つの既存データベースにある患者に関する情報を利用した病症ないし症状介入のための、コンピュータにて実行する方法であって、
a)　同定病症ないし症状に関する患者群の患者情報を抽出すべく、所定の基準に基づいてデータベースにおける患者情報を処理するステップと、
b)　i)同定病症ないし症状に適切な事象ないしデータの集合を、前記データベースで得られる情報を利用することで定義付け、
ii)前記抽出した患者情報と定義付けした事象ないしデータを事象レベル情報からなるファイルに変換し、
iii)定義付けした事象の特定部分を以後の処理で考慮すべきかどうかを判断する材料となる時間枠を生成するために時間ウィンドウを定め、
iv)潜在的予測子としての変数の集合を識別し、
v)分析ファイルを生成すべく、前記時間ウィンドウと変数の集合とを利用して事象レベル情報を処理し、
vi)前記変数の集合の部分集合の関数であると共に、同定病症ないし症状を有すると診断されたか、又は、同定病症ないし症状に罹患しそうな危険状態の患者を識別するのに用いる予測モデルとルールとを生成すべく、分析ファイルに対して統計分析を行うことにより、予測モデルを定義付けるステップと、
c)　同定病症ないし症状の危険状態にある患者を識別するか、又は、同定病症ないし症状に罹患しそうな危険状態にある患者を識別するために、同一又は新たな集合の事象レベル情報に前記予測モデルとルールとを当てはめるステップと、
d)　識別した危険状態の患者から介入リストを用意して、少なくとも一人の危険状態の患者のために介入を選択するステップと、
e)　前記患者に対して介入を施すか、又は、施せるように促進するステップと、
f)　所望に応じて、選択された介入に基づいて各危険状態の患者に対する介入結果を記録且つ追跡するステップと、
g)　所望に応じて、前記データベースに対応する各介入結果で少なくとも一つのデータベースにおける履歴データを更新するステップと、
h)　前記ステップｂ(ii)を繰り返すステップと、
I)　更新したデータベースにおけるデータから抽出した事象レベル情報に対して前記予測モデルとルールとを再度当てはめるステップとからなる方法。
【請求項２】　少なくとも一つの既存データベースにある患者に関する情報を利用した病症管理のための、コンピュータにて実行するシステムであって、
a)　同定病症ないし症状を有する患者群の患者情報を抽出すべく、所定の基準に基づいてデータベースにおける患者情報を処理する処理手段と、
b)　i)同定病症ないし症状に適切な事象ないしデータの集合を、前記データベースで得られる情報を利用することで定義付ける事象定義付け手段と、
ii)前記抽出した患者情報と定義付けした事象ないしデータを事象レベル情報からなるファイルに変換する変換手段と、
iii)定義付けした事象の特定部分を以後の処理で考慮すべきかどうかを判断する材料となる時間枠を生成するために時間ウィンドウを定める手段と、
iv)潜在的予測子としての変数の集合を識別する手段と、
v)分析ファイルを生成すべく、前記時間ウィンドウと変数の集合とを利用して事象レベル情報を処理する手段と、
vi)前記変数の集合の部分集合の関数であると共に、同定病症ないし症状を有すると診断された患者を識別するのに用いる予測モデルとルールとを生成すべく、分析ファイルに対して統計分析を行う手段とからなる、予測モデルを定義付ける手段と、
c)　同定病症ないし症状について危険状態にある患者を識別するために、同一又は新たな集合の事象レベル情報に前記予測モデルとルールとを当てはめ、
d)　識別した危険状態の患者から介入リストを用意して、少なくとも一人の危険状態の患者のために介入を選択する手段と、
e)　前記患者に対して介入を施すか、又は、施せるように促進する手段と、
f)　所望に応じて、選択された介入に基づいて各危険状態の患者に対する介入結果を記録且つ追跡する手段と、
g)　所望に応じて、前記データベースに対応する各介入結果で少なくとも一つのデータベースにおけり履歴データを更新するか、又は、ステップ(ｆ)にて得られた前記データを利用して小データベースを生成する手段と、
h)　ステップｂ(i)を繰り返す手段と、
i)　更新したデータベースにおけるデータから抽出した事象レベル情報に対して前記予測モデルとルールとを再度当てはめる手段とからなるシステム。
【請求項３】　コンピュータデータベースにおける患者情報から健康介入プロダクトを生成する方法であって、
a)　同定病症ないし症状を有する患者群の患者情報を抽出すべく、所定の基準に基づいてデータベースにおける患者情報を抽出して処理するためにコンピュータを利用するステップと、
b)　i)同定病症ないし症状に適切な事象ないしデータの集合を、前記データベースで得られる情報を利用することで定義付けるステップと、
ii)前記抽出した患者情報と定義付けした事象ないしデータを事象レベル情報からなるファイルに変換するステップと、
iii)定義付けした事象の特定部分を以後の処理で考慮す

べきかどうかを判断する材料となる時間枠を生成するために時間ウィンドウを定めるステップと、
iv)潜在的予測子としての変数の集合を入力するステップと、
v)前記時間ウィンドウと変数の集合とを利用して事象レベル情報を処理することで分析ファイルを生成するステップと、
vi)前記変数の集合の部分集合の関数であると共に、同定病症ないし症状を有すると診断された患者を識別するのに用いる予測モデルとルールとを生成すべく、分析ファイルに対して統計分析を行う手段とからなる、予測モデルを定義付けるステップとからなる予測モデルをコンピュータにプログラム化するステップと、コンピュータにおいて、
c)　同定病症ないし症状について危険状態にある患者を識別するために、同一又は新たな集合の事象レベル情報に対して前記予測モデルとルールとを実行させるステップと、
d)　識別した危険状態の患者から介入リストを出力して、少なくとも一人の危険状態の患者のために介入を選択するステップと、
e)　前記患者に対して介入を施すか、又は、施せるように促進するステップと、
f)　所望に応じて、選択された介入に基づいて各危険状態の患者に対する介入結果を記録且つ追跡するステップと、
g)　前記データベースに対応する各介入結果で少なくとも一つのデータベースにおけり履歴データを更新するか、又は、前記データを利用して新たなデータベースを生成するステップと、
h)　ステップｂ(i)を繰り返すステップと、
i)　ステップ(ｇ)にて生成したデータベースにおけるデータから抽出した事象レベル情報に対して前記予測モデルとルールとを再度実行するステップと、
j)　ステップ(ｇ)にて生成したデータベースに対して予測モデルとルールとをサイ痔実行して得た介入リストを出力するステップとからなる方法。
【請求項４】　a)　同定病症ないし症状を有する患者群の患者情報を抽出すべく、所定の基準に基づいてデータベースにおける患者情報を抽出して処理するためにコンピュータを利用するステップと、
b)　i)同定病症ないし症状に適切な事象ないしデータの集合を、前記データベースで得られる情報を利用することで定義付けるステップと、
ii)前記抽出した患者情報と定義付けした事象ないしデータを事象レベル情報からなるファイルに変換するステップと、
iii)定義付けした事象の特定部分を以後の処理で考慮すべきかどうかを判断する材料となる時間枠を生成するために時間ウィンドウを定めるステップと、
iv)潜在的予測子としての変数の集合を入力するステップと、
v)前記時間ウィンドウと変数の集合とを利用して事象レベル情報を処理することで分析ファイルを生成するステップと、
vi)前記変数の集合の部分集合の関数であると共に、同定病症ないし症状を有すると診断された患者を識別するのに用いる予測モデルとルールとを生成すべく、分析ファイルに対して統計分析を行う手段とからなる、予測モデルを定義付けるステップとからなる予測モデルをコンピュータにプログラム化するステップと、コンピュータにおいて、
c)　同定病症ないし症状について危険状態にある患者を識別するために、同一又は新たな集合の事象レベル情報に対して前記予測モデルとルールとを実行させるステップと、
d)　識別した危険状態の患者から介入リストをハードコピーないし機械読取り可能な形で出力して、少なくとも一人の危険状態の患者のために介入を選択するステップと、
e)　前記患者に対して介入を施すステップと、
f)　所望に応じて、選択された介入に基づいて各危険状態の患者に対する介入結果を記録且つ追跡するステップと、
g)　前記データベースに対応する各介入結果で少なくとも一つのデータベースにおけり履歴データを更新するか、又は、前記データを利用して新たなデータベースを生成するステップと、
h)　ステップｂ(i)を繰り返すステップと、
i)　ステップ(ｇ)にて生成したデータベースにおけるデータから抽出した事象レベル情報に対して前記予測モデルとルールとを再度実行するステップと、
j)　ステップ(ｇ)にて生成したデータベースに対して予測モデルとルールとをサイ痔実行して得た介入リストを出力するステップとからなる方法により創出した健康介入プロダクト。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、人の健康管理の分野での電子演算処理技術に関し、詳述すれば、種々の電子演算処理技術を利用して病症と病症介入管理と実施すべき危険状態の患者を識別することに関する。
【０００２】
【従来の技術】病症ないし症状は、特定の好ましい養生法にも適った現在の医学安全指針とのコンプライアンスを症例ごとに最大化するプログラムを工夫することによりより効果的に、しかも、費用効果が大きくなるように治療することができる。大部分の病症の治療は、挿話的な対症療法から病症撲滅、病症防止へと変わっている。
【０００３】

【発明が解消しようとする課題】健康管理に要するコストは一般に高騰しており、大部分の場合では患者治療費は、一部の患者を治療するのに他の患者よりも沢山費用がかかることから、患者全員に均一に分配されていない。これは、一部の患者が当該患者の医学的状態に適した治療を受けていないことに部分的にも起因している。この問題には幾つかの原因があり、一部の患者が処方された治療法に従わなかったり、また、適時に医者を訪問しなかったり、医者としても現に使っている養生法よりももっと効果的な治療法があることをと知らないでいることなどが原因に含まれている。

【０００４】患者を、病症の進展具合のある状態には効果があると分かっている治療法で治療すれば、全患者群を治療するのに要する総費用は減少する筈である。より多くの患者を適切に治療すれば、病症がひどい状態へと進展して治療費が高くなる事例の数も減少する筈である。

【０００５】

【課題を解決するための手段】本発明はコンピュータにて実行する、危険状態の患者、特に同定病症を有するものと診断された患者を識別するシステムと方法であって、患者に関する情報が少なくとも一つの既存する少なくとも一つのデータベースにから取り出されるようになっている。システムは、同定病症を有するか、又は、それにかかりそうな患者のグループについて適切な情報を抽出するべく、所定の基準に基づいてデータベースにおける患者情報を処理する手段を備えている。このシステムは下記のようにして、連合ルールを含む予測モデルを構築する。

【０００６】a)　同定病症ないし症状に関する患者群の患者情報を抽出すべく、所定の基準に基づいてデータベースにおける患者情報を処理し、

b)　i)同定病症ないし症状に適切な事象ないしデータの集合を、前記データベースで得られる情報を利用することで定義付け、

ii)前記抽出した患者情報と定義付けした事象ないしデータを事象レベル情報からなるファイルに変換し、

iii)定義付けした事象の特定部分を以後の処理で考慮すべきかどうかを判断する材料となる時間枠を生成するために時間ウィンドウを定め、

iv)潜在的予測子としての変数の集合を識別し、

v)分析ファイルを生成すべく、前記時間ウィンドウと変数の集合とを利用して事象レベル情報を処理し、

vi)前記変数の集合の部分集合の関数であると共に、同定病症ないし症状を有すると診断されたか、又は、同定病症ないし症状に罹患しそうな危険状態の患者を識別するのに用いる予測モデルとルールとを生成すべく、分析ファイルに対して統計分析を行うことにより、予測モデルを定義付け、

c)　同定病症ないし症状の危険状態にある患者を識別するか、又は、同定病症ないし症状に罹患しそうな危険状態にある患者を識別するために、同一又は新たな集合の事象レベル情報に前記予測モデルとルールとを当てはめ、

d)　識別した危険状態の患者から介入リストを用意して、少なくとも一人の危険状態の患者のために介入を選択し、

e)　前記患者に対して介入を施すか、又は、施せるように促進して、f)選択された介入に基づいて各危険状態の患者に対する介入結果を所望によっては記録且つ追跡し、

g)　所望によっては前記データベースに対応する各介入結果で少なくとも一つのデータベースにおける履歴データを更新し、前記ステップb(ii)を繰り返した後に

h)　更新したデータベースにおけるデータから抽出した事象レベル情報に対して前記予測モデルとルールとを再度当てはめる。

【０００７】

【発明の実施の形態】

概　要

本発明による病症管理システムと方法では、病気ないし症状に対処するに当たって適切な治療を受けたり、当該治療下におかれたり、当該治療が施されている患者の数を一定の人口内で増加させることができる。本発明では、病状の進展の各段階ごとの好ましい治療養生法が分かっていることが必要である。この養生法は、すでに公開されている医学ガイドラインであっても良いし、又は、各種の病気に応じて健康管理専門家が開発したガイドラインであっても良い。これらのガイドラインは、医学安全指針(Best Practice Guidelines)と呼ばれている。

【０００８】「病症管理」なる用語は、入院治療費が高額になるとか、高コストを招聘するとか、好転が期待できないとかのリスクのある慢性長期症状のある患者を識別する、例えば健康管理組織、医学グループ、従業者、ないし政府支援計画などで用いるものである。病症管理サービスは、病症対処専門家として働く製品開発マネジャーについて研究分野で決められている。

【０００９】病症管理サービスは患者（管理ケア組織(MCO)やその他の加入機関に係わっている患者）に対して提供されるものであって、患者の病症がある特定の段階にある時に介入することで当該病症の将来の結果を好転させるためになされるものである。個人の病歴や、臨床歴、服薬歴などの情報は、例えば病症管理システムに係わる第三者から得られる。

【００１０】本明細書では主として、健康管理の分野で本発明の病症管理システムを利用した例について説明するが、その場合での健康管理プロバイダはシステムの主たるクライアントであり、この健康管理プロバイダの患者についての情報は本発明の実施で利用するデータベー

スに蓄えられる。しかし、クライアントとしては、例えば従業員や政府機関、保険プロバイダ、それに、病症管理ないし一定人口の個人の規制に関心のあるその他のユーザーである場合でも本発明が適用できる。同様に、病症管理システムのデータベースに蓄えられる情報は、人口統計データや社会データ、地理データ、家族歴、それに、個人についてのその他の情報を含むところまで拡張できる。

【００１１】基本的な病症管理システムは、一つの病症ないし症状を考察している。しかし、複合病症ないし症状の場合では、それを単一の分析に細分化して、複合要因と複合病症ないし症状によりリスクプロフィールを出すようにしている。このような方法では、それぞれの病症ないし症状をリレーショナルデータベースの分野と同様に関連付けのできるモジュールとしてとらえている。このようにすることで、特定の患者群に対するリスク要因を取り出すに当たり、複数の病症ないし症状を分析できるようになる。

【００１２】図１において、本発明による病症管理プロセスの高度なレベルの図を示すが、そこには患者の罹患情報ソース１００、予測健康結果モデリングプロセス１０２、危険状態患者の介入プロセス１０３、病症管理モデリングガイドラインソース１０４、介入及び医学的ガイドラインソース１０５が示されている。危険状態の患者の介入プロセス１０３には、リスク階層化１４０と介入管理プロセス１６０の二つの部分がある。患者の罹患情報ソース１００は、例えば健康管理プロバイダのプログラムに係わる患者の病歴の記録、健康状態記録、精神状態記録、ラボ試験結果、認識力及び知能試験データ、処方及び治療などを含むデータベースの形をしているのが通常である。

【００１３】図１の予測健康結果モデリング１０２は、ある病症ないし症状と病歴のある患者の健康状態がかえって悪化するかどうかを予測するのに用いることのできる統計モデルを生成するプロセスである。危険状態の患者の介入プロセス１０３は、かえって健康状態が悪化する可能性の大きい危険状態患者のリストをもたらすデータベース分析プロセスであるリスク階層化プロセス１４０と、斯かる健康悪化の可能性を減少させるために選ばれた患者の健康管理処置に介入すべきかどうかを判定する介入管理プロセス１６０とが含まれている。

【００１４】図１に示した本発明の病症管理プロセスの動作について説明する。先ず、予測健康結果モデリングプロセス１０２が、特定の病症について患者の罹患情報データベース１００から患者データのサンプル群を受け取る。そればかりではなくて、予測健康結果モデリングプロセス１０２は、図１においてモデリングガイドライン１０４として図示した予測モデルを生成するために所定の統計ないしその他の情報を受け取って、健康悪化の可能性の有無を判定するために特定病症の特定予測モデルを生成する。健康悪化に関係のある特定病症ないし症状が生ずる確率を判定するのに、同一ないし類似のデータを用いることもできる。

【００１５】リスク階層化プロセス１４０は、予測健康結果モデリングプロセス１０２が生成した予測モデルを受け取って、この予測モデルで患者罹患情報データベース１００からの個々の患者に特有のデータを分析して、特定病症に罹患している患者の健康状態が悪化する可能性の大きい患者のリストを明らかにする。このように患者のリストが明らかになると、介入管理プロセス１６０が、患者ないし医者、健康管理プロバイダと接触することで患者の治療プロセスに介入するように促すようになる。危険状態の患者の介入プロセス１０３には、病状の進展の各段階ごとの好ましい治療養生法と、図１において介入及び医学的ガイドライン１０５として示した特定の介入に関する外部生成情報が必要である。

【００１６】最後に、介入それ自体は記録してもよく、危険状態の患者の介入プロセス１０３が一旦終わると、図１において介入結果測定値として示したこれらの介入結果が患者の医学情報データベース１００に蓄えられる。これにより、介入語のデータを全体プロセスに亙ってフィードバックするフィードバックステップが、結果の分析を促進するためにリスク階層化ステップを通じて再び行われるようにするか、又は、新たな修正したリスク階層化プロセスを生成するためのベースの一部となるようにすることができる。

【００１７】要するに、病症管理システムは個々の患者に特有な健康情報の流れを分析して、必要時には医者ないし患者に介入して健康状態が悪化するようなことを避ける、従って、高コスト事象を避けるようにしている。この病症管理には、下記のことが含まれている。

【００１８】１）　研究データから導き出されるある所定の病症の状態の基づき、クライアントの組織とプログラムに参加すると期待される潜在患者を同定すること。

【００１９】２）　病症の状態を評価するために、医学上のクレーム、調剤上のクレーム、臨床データ、ラボデータを利用すること。

【００２０】３）　プログラムを管理維持するために予め定めた介入措置を利用すること。介入措置の一例として、定期的通知の発送、対症啓蒙材の発送、患者からの電話調査に対する返答、さらには、健康管理専門家による出向などがある。

【００２１】４）　クライアント（例えば、ＭＣＯ、健康管理プロバイダ）や医者、患者に対して必要な介入措置を実行する症例(case)プログラムマネジャーと共にプロセスを管理運営すること。

【００２２】５）　積極的な病症管理サービスで特定の病症の結末が向上するかどうかを判定するために、患者の健康管理への介入を記録すること。

【００２３】６）　介入に結果を判定するために、分析

プロセスに亙って介入管理情報を処理すること。
【００２４】本発明の方法にあっては、症例プログラムマネジャー（図１では示していないが、当該マネジャーの機能については、図２に示した、後述する症例管理プロセス１５０の一部として示してある。）は、療法の変更で恩恵を受けると思われる患者を医者に対して明らかにし、医者に対して治療法を提案する一方、患者（同時に治療担当医師）に対して教育上及び治療上のコンプライアンス処置をとることで、患者の治療をはかどらせるようになっている。症例プログラムマネジャーは病症を診断したり、治療養生法を処方するようなことはしない。医学上の診断と治療は資格のある医師の責務である。
【００２５】本発明の方法を利用することにより、症例プログラムマネジャーは療法を受けている患者、それより重要なことに、その患者の病症の状態に好ましい治療養生法に従って治療されていない患者の部分集合を明らかにすることができる。この患者群は本発明に非常に適しており、この患者群から好ましい治療養生法を受けていない患者の治療養生法が自動的に明らかになり、習慣の変更に影響を及ぼしたり、推奨治療養生法に合わせるように影響を及ぼすことができる。
【００２６】本発明の以後の説明においては、便宜上、症例プログラムマネジャーを、予測健康結果モデリングプロセス１０２のためのモデリングガイドライン１０４や、危険状態の患者の介入プロセス１０３のための介入及び医学的ガイドラインの如くの外部情報の単一ソースとして示す。
【００２７】一般に、症例プログラムマネジャーの大部分の機能は、例えば専用コンピュータシステムにより自動化されていると共に、実行される。しかし、末端ユーザーは、病症管理プログラムが開始されると外部情報を提供したり、経験に基づいて病症管理プログラムに対して修正した、もしくは新規なパラメーターを提供したり、或いは必要に応じて介入方法を変えることになる。
【００２８】本発明の大部分の実施の形態にあっては、症例プログラムマネジャーの役割を複数の人又は実体(entities)に分けている。例えば、一つの「症例管理」実体では、「高コスト」患者となる虞のある患者を見極め、別の実体はこの情報と治療上のアドバイスのみならず、患者の教材と治療上コンプライアンス装置を携えて医者に接触し、しかも第三実体が医者に直接接触すると言った具合になっている。また別の実体が、統計情報を識別し、予測モデルを生成する義務を負うことがある。本発明の方法を実行した結果、特殊で、しかも、費用のかかるケアを必要とする重病症に罹患した患者は少数で、大勢の患者が適切な療法を受けられた。
【００２９】本発明の方法では、少なくとも数人の治療医師が係わっているのが通常である。好ましい一実施の形態では約１００人ほどの治療医師が係わっているが、２５０～５００人の医師、或いはそれ以上の大勢の医師が係わって居ればより効果的である。
【００３０】病症管理システム
本発明の病症管理システムの高度なフローチャートを図２に示す。図２において、病症管理システムは、患者データ収集統合プロセス(Patient Data Collection and Integration process)１１０と病症管理データベース１２０とを含む病症管理データ書庫システム１０１からなる。これは、事象レベルでの情報が蓄えられるところである。次に、病症管理システムは、予測モデリングプロセス１３０と、リスク階層化プロセス１４０と、介入管理プロセス１６０と、介入記録追跡プロセス１７０とを備えている。
【００３１】症例管理プロセス１５０は介入管理プロセス１６０から介入情報を、また、介入記録追跡プロセス１７０からルールを受け取る。症例マネジャー１５０は予測モデリングプロセス１３０とリスク階層化プロセス１４０とに外部からでた情報を提供する。
【００３２】病症管理データ書庫システム１０１は、患者データ収集統合プロセス１１０と病症管理データベース１２０とからなる。患者データ収集統合プロセス１１０は、健康管理ソースから生の患者データを受け取って当該生の患者データを処理することで、冗長な情報を削除して共通する所定のフォーマットに体裁を整えるようになっている。最初の段階では、最初の患者群(initial population of patients)を想定するために情報ソースとしては一つかそれ以上必要である。
【００３３】生の患者データの出所としては、患者の記録を保存しているところであれば、例えば医者、病院、薬局の如くの健康管理プロバイダや、その他のプロバイダ、健康管理サービスに対して支払いをなす支払い者であっても良い。これらの記録は離散してしまったり、アクセスできなくなったり、フォーマットするのが困難で、重複した或いは不正確な情報を含んでいるようなことがある。従って、斯かる情報に容易にアクセスできる情報ソースとしては、特定の給付金プロバイダ(benefits provider)の健康管理クレーム記録書に見いだすことができる。本発明の典型的な実施の形態では、このような健康管理クレーム記録書を利用している。
【００３４】患者データ収集統合プロセス１１０は、フォーマットした患者情報を病症管理データベース１２０に蓄える。この病症管理データベース１２０は、本発明で利用する患者の病歴や臨床データ、その他のデータを蓄えているところである。
【００３５】本発明の予測モデリングプロセス１３０は、判明している病症や統計上の制約、それにサンプル患者データベースなどを利用して、所定の同定病症の患者群からして健康状態が悪化する可能性のある患者を同定する予測モデルとルールとを生成する。本明細書において用いる「同定病症」とは、喘息とか、鬱病、充血性

心不全（ＣＨＦ）の如くのクライアントが関心を持っている病症を意味する。

【００３６】図２に示したリスク階層化プロセス１４０は、所定の基準に基づいて病症管理データベース１２０から選択したグループの患者に対応する病症管理データベース１２０からの患者データに対して統計上の予測モデルとルールとを適用する。この所定基準としては、例えば「全クライアント（ＭＣＯ）患者」又は「全新雇用人」であってもよい。リスク階層化プロセス１４０で、危険状態の患者(at-risk patient)のサブグループを同定して、このサブグループから介入リストを生成する。

【００３７】介入管理プロセス１６０は、このような危険状態の患者に対して手紙や啓蒙材を送付したり、電話をかけたり、自宅訪問をしたりするとかなど、介入リストに上げられている同定患者に対する介入のスケジュールを立てたり、それを行うようになっている。最後に、介入記録追跡プロセス１７０では、行った介入の記録をその結果とを保存する。

【００３８】図２に示した病症管理システムの動作について以後、説明する。先ず、問題になっている特定の病症とその他の所定制約が症例管理プロセス１５０で確定される。同定病症と制約とは予測モデリングプロセス１３０に供給される。この予測モデリングプロセス１３０は、同定病症を有する患者に対応し、且つ、研究データから定められた所定の統計上基準を満たす病症管理データベース１２０からのサブグループの患者医学データを受け取る。すると、予測モデリングプロセス１３０は、健康状態が悪化しかねない危険状態にある所定の同定病症の患者群から患者を同定する予測モデルとルールとを前記患者医学データのサブグループに基づいて生成する。

【００３９】リスク階層化プロセス１４０は予測モデリングプロセス１３０から出力された予測モデルとルールを、症例管理プロセス１５０から別のルールを受け取る。症例管理プロセス１５０から供給された情報に基づいて、病症管理データベース１２０に含まれている一群の患者の医学臨床情報が検索され、その一群の患者は所定クライアントの同定病症患者群となる。その後、リスク階層化プロセス１４０が予測モデルとルールとを利用して、健康状態が悪化しかねな危険状態にある所定クライアントの同定病症患者群から高度危険状態の患者のサブグループを同定する。

【００４０】高度危険状態のサブグループを同定することは、操作者が決める主観的な行為である。むりやりに押しつけられるものではない。例えば「高度危険状態(high-risk)」は、病症ないし病状の重さに応じて決まる。或いは、入手し得るリソースにより駆られることもある。有用な介入を提供するコストを鑑みるに沢山のリソースが入手し得る。「高度危険状態」の古典的な一例としては、重大人身被災に対処する際に用いられる選別法、即ち、死亡可能性の大きい場合は治療しない、生存可能性の大きい場合も治療しない、介入することで生存率が大きくなるか、又は、永久廃疾になるのを緩和できる場合は治療する、との選別法がある。別の一例としては、高度危険状態のサブグループを、特定のオペレーションで何人の患者を扱えるかに基づく全グループの内の一定割合からなるものと定義づける方法がある。従って、特定のシステムのスループットが特定の日に１０００人の患者を扱える、もしくは管理できるのであれば、全人数の内の１０００人の患者が「高度危険状態」のサブグループであると定義することができる。同様にして、介入者としては、６カ月間に１０００人の患者に対して有用に介入するのに充分な費用だけ所持することさえあり得る。従って、この定義に従えば、高度に危険状態にあるこの１０００人の患者が「高度危険状態」サブグループになる。また別の一例としては、考えられる有益な結果からして臨床結果を１～５まで格付けする方法があり、その方法では、３かそれより大きい数値に格付けされた好結果をもたらすものとみなされた患者を「高度危険状態」サブグループとしてはかどらせるようになっている。また、年齢や、年齢別による悪効果の発生率(age-related likelihood of an adverse outcome)、好転率(a positive outcome)なども、「高度危険状態」サブグループを定めるのに利用できる。例えば、閉経期の女性で、エストロゲン依存性病症を経験した家族のいる患者を高度危険状態患者と定めることもあり得る。それに、「高度危険状態」サブグループを同定するアルゴリズムを生成するに当たっては、これらの要因を二つやそれ以上組み合わせることも考えられる。

【００４１】また、このステップを一つの「高度危険状態」サブグループを同定するものとして説明しているが、介入にその程度に応じてレベル分けしてこの分析に取り入れることもできる。従って、高度危険状態サブグループを定義付けするよりは、特定のリスク度(risk factor)を割り当てたサブグループの集合を定めて、リスク評価の異なったレベルに基づいて選択したサブグループの集合に対して介入を行うようにすることも考えられる。

【００４２】高度危険状態サブグループないしターゲットサブグループの集合が判明すると、リスク階層化プロセス１４０が所定基準に従って患者をランク付けした介入リストを生成する。本発明の介入管理プロセス１６０はこの介入リストを利用して、危険状態の患者に対して手紙や啓蒙材を送付したり、電話をかけたり、自宅訪問をしたりするとかなどの介入のスケジュールを立てたり、それを行うことで、当該患者の健康状態が悪化するのを防ぐか、又は、改善するようになっている。

【００４３】介入管理プロセス１６０は病症管理データベース１２０から送られるデータを取り込むが、このデータは「クライアント」同定病症患者データであって、

病症管理データ書庫の体裁に標準化されている。このデータ供給ないし検出プロセスには、病症プログラムに関与するための条件に合致した特定の患者を同定するパラメータとルールとが症例管理プロセス１５０から送られている。この検出プロセスで、特定の同定病症プログラムで考慮する個体群が得られる。

【００４４】以後、図２に示した本発明の病症管理システムの各プロセスについて詳述する。

【００４５】病症管理データ書庫とデータ統合

病症管理データ書庫１０１については、図３において、生の患者データ獲得、予備処理、データベース形成を示す高レベルのフローチャートを参照しながら説明する。病症管理データ書庫１０１は患者データ収集統合プロセス１１０と病症管理データベース１２０と研究データベース２５０とからなる。

【００４６】患者データ収集統合プロセス１１０は、データソースとしての経費請求ソース(Reimbursement Claims source)２００と、生の患者データを「一掃(clean-up)」する生患者データ予備処理プロセス２１０と、生のデータを所定の体裁に変換する変換プロセス２２０と、その後の事象ないし介入により患者情報（この情報は、事象レベル情報とも言われている）を更新する更新患者データプロセス２３０とからなる。

【００４７】患者データ収集統合プロセス１１０においては、経費請求ソース２００から生患者データ予備処理アルゴリズムに生の患者データが供給される。現に医療を受けている患者の群を同定するための情報ソースの一例としては、大勢の健康管理給付金プロバイダ(benefits provider)の臨床記録、健康管理クレーム記録(health care claim record)などがある。よく知られているように、薬代、医者訪問、病院滞在、ラボ試験に対するクレームは支払い／経費の算出に受け付けられて処理されている。本発明の典型的な実施の形態にあっては、このクレーム情報(claim information)は、例えばＤＢ２ないしコンピュータシステム（図示せず）のサイベース(Sybase)データベースに入力されている。

【００４８】しかし、本発明は図示の如くの経費要求ソース２００に限定されるものではない。本発明の別の実施の形態では、人口統計データの如くの個人に関するデータや、社会データ、生活スタイル、性的虐待ないし両親による育児放棄ないし肉体的虐待の履歴、栄養状態などの如くの個人データ、家族歴、地理データ、その他のデータを利用して病症管理データベースを構築している。

【００４９】本発明の方法は、通常、経費要求ソース２００からの個人に関するデータで、例えば医学データ、人口統計データ、服薬データ、診断データ、治療データなどを記憶し、検索できる電子データベースの助けを借りて実行されるものである。例えば、経費要求から下記の服薬データが検索されるようになっている。

【００５０】ａ）　患者識別子
ｂ）　処方薬
ｃ）　服薬量
ｄ）　薬の量
ｅ）　施薬治療期間
ｆ）　最近の処方薬投与日
ｇ）　プロバイダ識別子

【００５１】これらのデータは好ましくは機械読取り可能な形になっていると共に、各患者ごとの慎重な記録とともに慎重に、しかも検索し得るフィールドで回収できるようになっているのが望ましい。また、各記録は、本明細書で説明している一つかそれ以上の症例管理介入を行ったかどうかについて述べているフィールドからなるのが望ましい。このデータはコンピュータに記憶され、カスタマイズしたデータベース利用ソフトを利用してアクセスできるようになっている。このようなソフトは、検索機能のみならず、報告（表示、印刷、電子頒布）機能をも有している。

【００５２】図４は、本発明で利用するのに適した三つの情報ソースを示した高レベルのブロック図である。図２に示したように、そのようなプロバイダのクレーム情報には、一般に、薬局（Ｒｘ）クレーム２０２、医者（Ｄｒ）クレーム２０４、病院（ＨＬ）クレーム２０８の三種の情報ソースがある。クレーム情報を表すブロックに列記したように、それぞれのクレームからは、薬コード、医者名、診断コード、処置、種々の日付、それにその他の適当な情報を色々な情報が得られる。大部分のこの情報は、薬コード、処置コード、病気コードの如く、コードを用いて表されている。

【００５３】図３へ戻って、生患者データ予備処理器２１０は、却下した或いは調製したクレームを識別して処理するデータ保全チェック(data integrity check)を実行する。

【００５４】データベースをもっと効率的に利用するために、生患者データ予備処理アルゴリズム２１０のデータベース利用サブアルゴリズム（図示せず）には、冗長な入力情報を除去したり、資格喪失の患者についての入力情報を除去したり、所定の期間内に症例管理介入を行った記録を無視する機能を有している。

【００５５】その後、変換アルゴリズム２２０がソースデータファイルを読み込んで、患者情報で病症管理データベース２４０を所定のデータベースの体裁に構築する。本発明の病症管理データベース２４０ではサイベースを用いているが、その他の類似のデータベース製品を用いることもできる。

【００５６】最後に、図３の更新患者データプロセス２３０は、介入管理プロセス１６０と介入記録追跡プロセス１７０とから介入管理情報を取り入れて、会員患者に関する介入情報を含ませるように病症管理データベース１２０の患者情報を更新する。

【００５７】変換プロセス２２０の典型的な実施の形態については、図５に詳細なフローチャートの形で示してある。

【００５８】図３において、ファイルマネジャー３１０は、患者データファイルを受け取って入力されたファイルを識別するとともに、それが処理に適しているかどうかを確認し、ファイル目録データベースに各ファイルについての情報を保存する。当該ファイルが階層別(Hierarchical)のものであれば、ファイルマネジャー３１０は階層別ファイル予備処理器に当該ファイルを送って内容をフラットファイルに読み込む。すると、フラットファイルが、入力環境テーブル３４０と出力環境テーブル３５０とに含まれている情報を利用することでフラットファイル処理器３３０により病症管理データベース２４０に保存される。患者データはその後データモデルを用いることでデータベースに保存される。

【００５９】図６は、本発明の一実施の形態における患者データ書庫で用いられている如くの典型的なデータモデルを示したものである。このデータモデルには、データベース構築のサイに入力されるデータの特徴を記録するソースデータ書庫４１０と、構築プロセスのサイにデータ例外事項を処理する例外処理プロセス４２０と、病症管理プロバイダクライアントのリストを含むクライアントテーブル４３０と、会員に特有な識別情報を含む会員テーブル４４０とからなる。

【００６０】また、データモデルには、会員テーブル４４０における各会員患者毎に、一人の会員に対する健康管理活動の記録であるクレームテーブル４５０と、特定の会員についての臨床試験データを収集するのに関係のある実体と関係を表すラボテーブル４６０と、特定のクレームごとの診断と医学処置の記録である診断処置テーブル４７０をも含んでいる。

【００６１】データモデルの組織化プロセスは下記の通りである。図６において、ソースデータ目録４１０は、データベース構築プロセス中に入力するデータの進展と特性とを記録する。例外処理４２０は構築プロセス中にデータの例外事項を処理する。例外は、値を失うか、値が範囲外になるとか、データにおけるその他の誤りにより発生するものであり、例外処理４２０が例外事項が発生した時点で、データを捨てるか、一部のデータを保持する、或いは入手し得る情報に基づいて誤りを解消することによりこれらの例外事項を解消するようになっている。

【００６２】クライアントテーブル４３０には、患者を抱え、本発明のシステムと方法とに参加している病症管理プロバイダクライアントのリストが含まれている。クライアントテーブル４３０における各クライアントは、会員テーブル４４０に会員として定義づけられている患者を有している。会員テーブル４４０には会員名、誕生日、性別の如くの情報が含まれている。

【００６３】会員テーブル４４０における各会員患者毎にクレームテーブル４５０が保持されている。クレームテーブル４５０における各クレームは、一人の会員に対する健康管理活動の記録である。記録されているデータ項目には例えば、クレームが出された日又は解消した日付、薬及び処方に関する情報、医学検査の詳細事項、会員の主治医ないしその他の医者、及び提供されたサービスないし処置などがある。

【００６４】また、ラボテーブル４６０は、特定の会員について実施したラボ検査の必要条件(requisition)、アクセス(accession)、解決(resolution)に関係のある実体と関係を表すものであり、記録されているデータ項目としては、血液検査、グルコース検査、一つの分析物に基づくその他の検査などがある。

【００６５】最後に、診断処置テーブル４７０は、ICD-9-CMコードとして表される特定のクレームに対する主たる診断と一つかそれ以上の副次的診断を記録している。診断は、まとめて診断関係グループ（ＤＲＧ）にすることができ、ＤＲＧは、患者が似たリソース消費と滞在パターンを示す４９５もある診断分類の一つである。診断処置テーブル４７０は、各診断に対応する処置をも記録しており、これらの処置は外患者ＣＰＴコード(out-patient CPT codes)、病院内ＨＣＰＣＳ(in-hospital HCPCS)、又は、登録コード(proprietary codes)として表されることがある。

【００６６】第２同定病症特有データベースを生成するが、これは、同定病症患者データのデータベースを予測モデリングプロセス１３０に供給するためである。図３に戻って、このデータベースは研究データベース２５０であって、ＳＡＳフォーマットの如くの所定の体裁でのクレームレベルデータベースである。図３では研究データベース２５０を構築するのに用いた同定病症サンプル患者データが病症管理データベース１２０から供給されるものとしているが、本発明はそれに限定されるものではなくて、研究データベース２５０を適当な予備処理アルゴリズムを用いることで経費要求ソース２００から構築しても良いものである。

【００６７】研究データベースに含まれるＲｘ、ＤＲ、ＨＬクレームのそれぞれの研究データベースフォーマットの一例を図７に示す。図７に示したように、クレームされている特定のサービスプロバイダも出ているから、クレーム１からクレームｘまでと適当な情報とのクレームが列挙されている。ＤＢ２データベースは、生患者データ予備処理アルゴリズム２１０による処理を必要とする生データエレメントのソースを表している。その後、研究データベース２５０へデータと定期的にダウンロードする。

【００６８】予測モデルの生成

統計予測モデリングについて言えば、図８は、本発明による同定病症のためのサンプル患者データ抽出プロセス

と予測モデリングプロセスを示す高レベルのフローチャートである。図８に示したように、予測モデリングプロセス１３０は、（１）同定病症サンプルデータの抽出ステップ６１０と、（２）品質管理操作（オプション）を実行するステップ６２０と、（３）データが統計上有効かどうかをチェックするステップ６３０と、（４）クレームレベルのデータを事象レベルのデータに変換するステップ６４０と、（５）事象レベルのファイルを分析ファイルに処理するステップ６５０と、（６）統計学的技法を用いて分析ファイルを処理することで同定病症予測モデルとルールとを生成するステップとからなる。

【００６９】図８において、予測モデルを求めるプロセスはステップ６１０、即ち、同定病症サンプルデータの抽出から開始する。この抽出ステップ６１０では、データがＳＡＳフォーマットに変換されると、研究データベース２５０からサンプル患者データを、また、症例管理プロセス１５０から同定病症が入力される。ＳＡＳ手順では情報を処理して、（１）同定病症の患者を抽出（ステップ６１０）し、（２）クレームレベルの情報を事象レベルの情報に処理（ステップ６４０）し、（３）所定の変数と時間枠とを利用して分析のための分析ファイルを生成（ステップ６５０）し、（４）健康状態が悪化するような結果との相関関係に最もよく反映した変数の関数として予測モデルを生成（ステップ６６０）するようになっている。

【００７０】尚、統計学的な観点からして、データベースから予測モデルを開発するに当たって考慮しなければならない重要な点はサンプルサイズである。予測モデルの完全性を最大化するためには、有効なサンプルサイズが重要な要素であり、予測方程式を求めるに必要なサンプルサイズは、変数間の連合の大きさに依存する。これらの連合については未知であるから、個々の計画に関わる患者は全て始めから含ませておく。

【００７１】第１ステップ、即ち、同定病症ないし症状を有する患者の抽出（ステップ６１０）では、症例プログラムマネジャー、研究ソース、又はその他の健康管理専門家から得られる種々のパラメーターを用いて、考慮すべき同定病症患者の当初の全員(overall initial universe of patients)に対してどの患者が資格を有しているかを定めている。

【００７２】例えば、本発明の一実施の形態においては、１２カ月かそれ以上の長きに亙って給付金プロバイダに連続して登録されていると共に、うつ病もしくは抗うつ薬投与による治療に対するクレームを有する患者のみが資格を有している。言うまでもないことではあるが、この基準は一例に過ぎず、例えば２４カ月ないし６カ月の登録だけでも十分とか、年齢としては１８才でなければならないとか、そう言ったように基準を変えることもできる。本発明の好ましい実施の形態では、同定病症サンプルデータの抽出ステップ６１０では、同定病症（例えばうつ病。付帯書類Ｉを参照のこと）に適したコードか、又は、同定病症の治療で用いる薬での治療（例えばうつ病の場合では、抗うつ薬。付帯書類IIIを参照のこと）に適したコードと共に患者の全てのクレームデータを抽出するようになっている。

【００７３】健康管理産業界では、どの処置、治療、診断、薬などがクレームされたいるかを判断するのにクレーム情報に種々のコードを用いている。本発明の実施の形態では、付帯書類ＩとＩＩとに示したようにコードが選定されている。これらのコードについては、アメリカ医学協会(American Medical Association)の「医者のための最新手続用語集(Physician's Current Procedural Terminology, CPT)」や、「聖アンソニーICD-9-CMコード集(St. Anthony's ICD-9-CM Code Book)」に開示されているところであり、これら二件の文献についてはコードとこれらのコードのソースを示すものとして本明細書に参考として挙げておく。当業者にはよく分かるように、本発明では、処置、治療、診断、薬などを表すコードならこれ以外のどのようなコードであっても利用できる。

【００７４】図８に示した抽出ステップ６１０の後、データ品質管理ステップ６２０において所望によりクレーム調整と完全性チェックとが行われる。この品質管理ステップ６２０はオプションであって、例えば同定病症の患者データがこのステップを必要としないこともあり、或いは、当初の病症管理データベース１２０が、生患者データ予備処理ステップ２１０（図３と図４）の結果、充分な品質を有しているような場合にこのステップを省略することができる。

【００７５】ステップ６２０での品質管理方法では、前述のデータセットから、処理のための頻度カウント(frequency count)を複数組含む中間出力ファイルを生成する。本発明の実施の形態にあっては、うつ病が同定病症である場合では下記特性の中間出力ファイルが検討のために生成される。

【００７６】ａ）　i)性別による会員のカウントを示したテーブル、ii)年齢群に該当する会員のカウントのテーブル、iii)性別で分けた年齢群のカウント、iv)登録期間、即ち、１カ月から最大可能月数のテーブルを含む、性別、年齢群（０～９、１０～１９、‥‥）、登録期間（月）での特定会員の頻度カウント、

【００７７】ｂ）　うつ病のICDコード（付帯書類Ｉ）の頻度カウント、即ち、少なくとも一つのヒットを有し、付帯書類Ｉ-ａにおける各ICDコードが第１コードとして如何なるレベルにある会員の数、

【００７８】ｃ）　抗うつ薬（付帯書類ＩＩ）の頻度カウント：

i)付帯書類IIIにある各薬につき少なくとも一つのクレームを有する会員の数

【００７９】ｄ）　ICDコードだけ、薬だけ、或いはICD

と薬との両方がために処置を受ける資格のある会員の数、
【００８０】ｅ）　会員ごとの各ファイル（ＨＬ、ＤＲ、Ｒｘ）にある全てのクレームの会員の頻度カウント、
【００８１】ｆ）　ＤＲ（何処でも良い）及びＨＬファイルにおけるあらゆる種のICDコード（ICDコードの最初の３つの数値だけを利用）の頻度カウント　－　それぞれの頻度の少なくともトップ１０、即ち、ＤＲ及びＨＬファイルに付きテーブル、
【００８２】ｇ）　暦上での入院頻度カウント。データの入手可能性又は資格を取った最後の月から逆算して月数を計数する。最後にデータが得られる月としては月１、その前の月としては月２と言った具合。
【００８３】ｆ）　うつ病（ＣＰＴコード、付帯書類Ｉ-ｂ）に関係ある措置の頻度カウント
【００８４】ｉ）　全てのＣＰＴコード（最初の３数値コードのレベルに対して）の頻度カウント
【００８５】データの完全性について予備評価を行うに際して利用される前述の頻度カウントはほんのの一例に過ぎず、有用又は無益なパラメータを含ませるか、削除するなりに改変できるものである。
【００８６】本発明の別の実施の形態では、充血性心不全が同定病症である場合では、下記の頻度カウントが生成される。
【００８７】Ａ）　最初に、会員の登録期間の数の頻度カウントを生成する。その後、少なくとも６カ月の複数の登録期間を有する会員の場合では、各登録期間中にＣＨＦ診断があったかどうかを判定する。その結果、ＣＨＦ診断のない登録期間は除外して、ＣＨＦ診断のあった最後の登録期間だけを保持する。
【００８８】Ｂ）　残りの全ての会員の登録期間が一つだけの場合では、全登録中に会員が経験したALL COSTSと称する全コストを判定する。ALL COSTSの完全なproc univariateが各計画ごと別々に、全ての計画につき一括して出される。尚、「proc univariate」とは、記述的統計（例えば平均、標準、偏位差など）を生成するＳＡＳ方法である。
【００８９】Ｃ）　判定したALL COSTSから、特に心血管系であるコスト（CV COSTSと称する）を判定する。判定するに当たっては、ＤＲ又はＨＬファイルからのクレームの第１又は第２位置にCV ICD-9コードが含まれておれば、コストはCV COSTとみなす。Ｒｘファイルからのクレームが医療クラス04000からのものであれば、ＣＶクレームとみなし、計数コストをＣＶコストとみなす。CV COSTSについての完全なPro Univariateも、各計画ごと別々に、そして全ての計画については一括して出される。
【００９０】Ｄ）　CV COSTSから、CHF COSTSと称する充血性心不全に関するコストを判定する。ＤＲないしＨＬファイルからのクレームの第１ないし第２位置にCHF ICD-9コードが含まれておれば、コストはCHF COSTとみなす。CHF COSTSについての完全なPro Univariateも、各計画ごと別々に、そして全ての計画については一括して出される。
【００９１】残っている全会員登録期間について、各計画ごとに全会員期間月間を別々に、そして一括して算出する。その際、会員が少なくとも一日だけ登録されていたとしても、当該会員はその月に登録されたものとみなす。そのため、会員月間についての完全なPro Univariateも、各計画ごと別々に、そして全ての計画については一括して出される。
【００９２】Ｆ）　最後に、残存登録期間にある全ての患者ステータスコード＝２０の場合にユニークな会員カウントを割り当てる。尚、ステータスコード＝２０であるということは、患者が死亡したか、又は回復しなかったことを意味する。
【００９３】尚、コスト計算については、本発明の好ましい実施の形態においては下記のガイドラインを適用している。
【００９４】ａ．　入院患者の入院、救急サービス、医者／外来患者、それのその他の医療サービスは、クレームごと、
AMTPAIR + AMTCOPAY + AMTRESERVE + AMTDEDUCT
とみなすことができる。
ｂ．　薬のコストはAMTPAID + AMTCOPAYとみなすことができる。但し、AMTPAIDは支払金額、AMTCOPAYは共同支払金額、AMTRESERVEは預り金、AMTDEDUCTは控除額をそれぞれ意味する。
【００９５】尚、コスト階層のために本発明の実施の形態では下記のルールを用いている。
１．CHFのための入院だけがその他の事象を産み出す。
２．病院費用には全てのＲｘ費、処置費、医者費が含まれている。
３．病院訪問により、コストがゼロ（病院費に含まれる）に設定されると共に、Ｒｘ事象と処置事象とが発生する。
４．病院訪問で別の医者による訪問事象が生ずることはない。
【００９６】繰り返すことになるが、データの完全性について予備評価するに当たって利用した前述の情報はほんの一例に過ぎず、本発明の範囲から逸脱することなく、有益もしくは無益と思われるパラメーターを含ませたり、又は除去するなりに改変しても良いものである。
【００９７】この情報を利用して、入力情報が有効ではなかったことから最終結果、即ち、予測モデルがねじ曲げられてしまうようなことがないようにするために、最初の同定病症の患者について「品質チェック」を行っている。データ品質を維持するこの処理、即ち、品質管理操作ステップ６２０では中間出力ファイルを生成して、

例えば全てのクレームが６０歳以上の人からのものか、男性からのものかの如くの不均衡、もしくは、予測モデルの完全性に欠陥が出るようなその他のデータの不均衡があるかどうかをチェックすることにより抽出した情報を磨き上げることができる。実施の形態におけるステップ６２０は、中間出力ファイルを見ながら手操作にて行われるようにしている。しかし、種々の閾値を用いることで考えられる不均衡に対して頻度カウントを自動的にスキャンするようにすることも考えられる。

【００９８】後での処理に適切と思われる種々の所定基準に従ってクレームレベルでの情報を抽出して磨き上げると、情報を事象レーベルのフォーマットに変換する。

【００９９】図８において、次のステップはクレームレベルのデータを事象レベルのデータに変換するステップ６４０である。処理に融通性を持たせるために、特に分析のために時間ウィンドウを割り当てるに当たり、前述の第２ステップ（即ち、クレームレベルの情報を事象レベルの情報に変換するステップ６４０）を用いて、分析ファイルが生成できる二つの主データファイルを作り出している。

【０１００】本発明の好ましい実施の形態では、主データファイル１は会員レベルファイルで、（１）会員キー、（２）誕生日、（３）性別、（４）最初の登録日（即ち、データセットの開始日(1/1/92)ないし登録日）、（５）登録終了日（即ち、データセットの終了日ないし登録最終日）、（６）最初に同定された病症事象（例えば、抗うつ薬の最初の処方日又は充血性心不全による入院日）、（７）退院日、（８）事象ファイル（主ファイル２）における記録数、（９）データセットへの入力モード（即ち、i)抗うつ薬のみ、ii)抗うつ病診断のみ、iii)抗うつ薬とうつ病診断の両方）の如くの静的なもの（即ち、時間に影響されない）の全てのデータを含んでいる。

【０１０１】主データファイル２は、会員により発注された各事象ごとの記録と事象の日付とを含む事象レベルファイルであり、本発明にあっては事象発生日から降順に表されている。

【０１０２】尚、時折エピソードとも言う事象は、臨床知識に基づいて同定病症に適切と思われる発生事項である。クレームからどんな生データエレメントが得られるかの知識があれば、事象の集合は、事象が個々のデータエレメント又はデータエレメントの組合せに基づいている場合、データエレメントから直接又は間接的に定めることができるか、又は、個々ないし複合データエレメントから導き出すことができる。

【０１０３】図９は、同定病症がうつ病である場合での主ファイル２（事象レベルファイル）のための事象の典型的なリストとそのフォーマットを示している。図９に示したように、入力項目には下記の項目が含まれている。

【０１０４】１．うつ病での入院

a.　病院所在場所コードで識別されている病院のクレーム

b.　少なくとも１日の開始日から経過期間がある。

c.　ICD９コードがある。

d.　うつ病ICD９コードが何処にもある。

e.　病気標識子(illness indicator)（付帯書類Ｖ）１＝主たる病気、２＝自殺、３＝主たる病気と自殺、０＝その他

【０１０５】２．うつ病での救急室

a.　救急室所在場所コードで識別されている救急室訪問

b.　ICD９コード（付帯書類Ｉ-ａ）がある。

【０１０６】３．うつ病での医師（非病院）訪問

a.　医師のクレーム

b.　ICD９コード（付帯書類Ｉ-ａ）がある。

c.　カテゴリー：　精神病医＝１、その他＝０

【０１０７】４．ＳＳＲＩの処方

a.　ＳＳＲＩ（選択的セロトニン摂取抑制剤）療法クラス5.51.3.

b.　病院の認可に伴うものであれば、コスト＝０

c.　カテゴリー標識子＝ブランク

【０１０８】５．ＴＣＡ（三環状抗うつ剤）又はMAOI（モノアミンオキシダーゼ抑制剤）のための処方

a.　治療クラス5.5.1.1（第三アミン）、5.5.1.2（第２アミン）、5.5.1.4（モノアミンオキシダーゼ抑制剤）。及び5.5.2

b.　病院の認可に伴うものであれば、コスト＝０

c.　カテゴリー標識子＝治療クラス１=5.5.1.1、２＝5.5.1.2、３＝5.5.1.4、４＝5.5.2

【０１０９】６．その他の神経活性剤（Ｒｘファイルから）

【０１１０】

７．うつ病に対する処置（ＤＲ又はＨＬファイルから）

カテゴリー：	ＣＰＴコード又はＩＣＤ処置
０＝精神療法	以後列記しない付帯書類Ｉ-ｂにおける全てのＣＰＴとＩＣＤコード
１＝診断	90801、90820、90825、90830、90862 94.0x、94.1x、94.21、99.22、94.23
２＝ショック療法	890870、908712 94.24、94.26、94.27

この項目につき、コストは、処置が発生した医者の訪問　　又は入院に割り当てている。

【０１１１】８．うつ病によらない入院
尚、項目８でのアイテムは、うつ病の診断を受けたとか、或いは抗うつ剤を服用していることから時としてうつ病のためになされている処置と思われることから、コーホートに入ってしまうことがあるものの、うつ病以外の症状に対して行う。
a．　少なくとも１日の開始日から経過期間がある全ての入院。
b．　主たる病気ＩＣＤ９コード（付帯書類Ｖ）
c．　カテゴリーについては上記１（１＝主、２＝自殺、３＝両方、０＝その他）
【０１１２】項目９～１３のカウントは１カ月間についてまとめている。日付は、認定病症の最初の発生日。数値の部分には、その月中に発生した同定事象の数をまとめる。
【０１１３】９．非うつ病による救急室
a．　救急室で識別する救急室訪問
１０．非うつ病による医者（外来患者）訪問
a．　医者訪問。
b．　うつ病診断を伴う訪問を除外（付帯書類Ｉ－ａ）即ち、上記３にないもの。
１１．関係のある薬の処方
付帯書類IVに記載の薬
１２．その他（うつ病によらないもの）の薬の処方
付帯書類IIIもしくはIVに含まれない全ての薬
【０１１４】１３．うつ病によらない処方（ＤｒとＨＬファイルから）
a．　カテゴリー標識子１＝大処置、２＝小処置（付帯書類IVを参照）
【０１１５】図１０は、充血性心不全が同定病症である場合での本発明の実施の形態による主ファイル２（事象レベルファイル）のための事象リストとフォーマットを示している。この実施の形態では、主ファイル１及び２が種々の事象のカウントをもたらす確実な(ground)ルールを用いて更に分類できる例を示している。
【０１１６】Ｉ．少なくとの１日の開始日から経過期間のあるクレームを、HOSPITALIZATIONと称する入院事象（第１及び第２ICD-9コードの両方を用いて）としてカウントする。尚、所在場所コードで考慮対象のサービスが行われた場所（例えば救急室、医者の事務所など）を区別している。また、コストは第１ICD-9コードカテゴリーのみに入れる。更に、以前の病院から退院した翌日に新たに入院するようなことが発生すれば、二ヶ所の病院を一つに橋渡しする。他方、以前の病院から退院してから相当日数の経過後に新たに入院するようなことが発生すれば、後の病院への入院を新たな入院とみなす。
【０１１７】II．所在場所コードが０７、０８又は１０であるクレーム又は病院共通処置コードシステム(Hospital Common Procedure Coding System, HCPCS)がプロバイダコードを８１とするA0010-A0070、A0215-A0225、A0999であるクレームを、ER VISITと称する救急室訪問事象（第１及び第２ICD-9コードの両方を用いて）としてカウントする。尚、コストは第１ICD-9コードカテゴリーのみに入れる。
【０１１８】III．所在場所コードが０１又は０６で、独特のサービス提供日（ＤＯＳ）を有しているが、同一ＤＯＳに異なったプロバイダキーを認めている（同一ＤＯＳに同一プロバイダキーがあれば、同一事務所訪問と取り扱う）クレームを、OFFICEVISITと称する事務所訪問事象としてカウントするが、この事務所訪問事象が入院中に発生した場合では、事務所訪問事象（この事象に伴う全てのコストは入院に帰するものとする）は出さない。また、ＨＣＰＣＳコードがプロバイダコードを８１とするA0080-A0210であるクレームをOFFICE VISITとしてカウントする。その他の事務所訪問事象については、コストは第１ICD-9コードカテゴリーのみに入れる。
尚、下記のプロバイダキーの場合では別の事務所訪問とはみなさず、もしあれば同一ＤＯＳに発生した事務所訪問とともに橋渡しする：１）２４（放射線治療）、２）２４、２５（独立ラボ）、３）５５（hosp o/pat lab x-線）。
【０１１９】前述した三つの事象の種類は、関連する診断により更に定義付けされる。
【０１２０】図８の次のステップは事象レベルのファイルを分析ファイルに処理するステップ６５０である。ステップ６４０に対応する前述の命令(instructions)を用いて二つの主ファイルを生成した後に、時間枠情報と選択した変数（従属及び独立変数）を用いた処理が事象レベルデータに対して実行され、それによりステップ６５０にて分析ファイルが生成される。
【０１２１】図１１は分析ファイルの典型的な体裁を示している。図示のように、分析ファイルの体裁には、表の第１カラムに会員のリストがある。表の頂部を横切っているものは変数のリストであり、これについては後述する。表の本体部には、列挙した変数に対する会員の関係についてのデータが記載されている。
【０１２２】殊に、ステップ６６０における主ファイルから分析ファイルへの処理では、一部が時間ウィンドウと複数の変数とで定義づけられるアルゴリズムが用いられる。このアルゴリズムは、種々の時間ウィンドウ調整と変数変更に合わせて再プログラム化できる。このステップで生成される分析ファイルは会員レベルのファイル（即ち、会員につぃして体系化したもの）でる。主分析ファイルは、主ファイルにおける情報から導き出される会員レベルファイルである。
【０１２３】各主分析ファイルは、調査済み(censored)事象の一つの基準時間ウィンドウと当該ファイルに関心のある予測ウィンドウとを考慮に入れるように生成されている。データに適用する各新時間ウィンドウは、本発明の実施の形態においては別の主分析ファイルを要して

いる。

【０１２４】分析ファイルを生成するためには、複数の変数と共に時間ウィンドウスキームを事象レベルデータに適用する。

【０１２５】先ず変数について論じると、独立変数と従属変数とが処理に含まれている。独立変数は基本的には健康状態の悪化の潜在的な予測子を表しており、従属変数は基本的には予測すべき健康状態の悪化を表している。

【０１２６】ステップ６５０のために一例としての独立変数を求めるためには、同定病症について何もなければ、できるだけ沢山のもとのデータエレメントを用いる。その後、同定病症についての臨床知識に基づいて、追加的な変数を生成する。また、臨床知識に基づくデータエレメントと変数の何れか一方、又は、両方の組合せを変数として利用する。最後に、一部の変数を生成して、病症管理での分かれ目として(as a leverage point)それらの潜在的な有用性に基づいて利用する。

【０１２７】本発明の典型的な実施の形態においては、充血性心不全（ＣＨＦ）を同定病症とする実施の形態での分析ファイルを生成するためにＳＡＳルーチンにおけるステップ６５０で現に利用している複数の変数を事象ファイルにおける各項目と共に表１に示す。尚、図１０における各事象は自動的に処理用独立変数とみなされる。

【０１２８】

表　１

追加的な独立変数

１．　年齢（最初のＣＨＦ診断時又は薬物治療時 － 三つの内の一つ）
２．　性別（Ｍ／Ｆ）
３．　ＨＭＯメンバーシップ（特定のＨＭＯの指定）
４．　最初のＣＨＦ診断場所（所在場所コード）
５．　虚血性心臓病（Ｙ／Ｎ）
６．　糖尿病（Ｙ／Ｎ）
７．　好ましくない生活スタイルの診断（Ｙ／Ｎ）
８．　心不整脈（Ｙ／Ｎ）
９．　その他の心臓病（Ｙ／Ｎ）

【０１２９】従属変数について言えば、例えば本発明での利用が考えられている潜在的な従属変数としては予測すべき結果がある。ＣＨＦの場合では、そのような結果には下記のものがある。

【０１３０】１．ＣＨＦによる入院（ＨＬ）。これはＨＬ標識子(HL indicator)として称される二分の変数であって、許可があればＨＬ＝１、それ以外では標識子は０。

【０１３１】２．高コスト。例えば、高コスト標識子は、ドルでのリソース利用率の最高１０％としても良い。リソースは最初のＣＨＦ診断のトップ１０％にある費用時から、又は、最初のＣＨＦ関係薬（記録上）の受領日＋１、３、６カ月からカウントする－各時期ごと別々に分析。これもHigh Cost標識子と称される二分の変数であって、例えば患者がトップ１０％にあれば、High Cost = 1であり、それ以外ではHigh Cost = 0。

【０１３２】高コスト標識子は本発明の実施の形態では、予測領域（ＢからＣ）においての会員ごとの総費用の分布（ＰＭＰＭ）と見ることもできる。総費用分布でのＰＭＰＭが最高の１０％の会員の場合での高コスト標識子は１であり、それ以外では０。

【０１３３】３．死亡

【０１３４】特定の例について三つだけの従属変数を挙げたが、当業者にはよく知られるように、本発明の目的にかなったその他の既知の、或いは未知の変数を本発明の範囲内で利用できることは容易に理解されるところである。

【０１３５】分析ファイルの生成についての時間ウィンドウについて言えば、選ばれた各階員につき一つの分析記録しかない。

【０１３６】本発明においては、分析ファイルを生成するために予測領域と調査データ(censoring data)を定める後述のスキームを開発している。即ち、図１２において、時間ウィンドウが基本的には予測ゾーンないし領域９１０と、該予測ゾーンにおけるなにかを予測するのに活動(activity)が利用される事象ウィンドウ（分析領域）９１２とを定めている。当業者には明らかなように、本発明では別の時間ウィンドウスキームを適当に利用できるのは明らかである。

【０１３７】説明の都合上、クレーム歴がカバーする時間をどこか「Ａ」点から始まって「Ｃ」点で終了する時間ウィンドウと称することにする。この時間間隔は、Ａ＜Ｂ≦Ｃの関係にある「Ｂ」点により分析及び予測領域に区画されている。即ち、「Ｂ」は現在を、「Ａ」ははるかに以前の事象を、「Ｃ」はもっと先の事象を表すことになる。

【０１３８】例えばジェーン・ドーの分析記録が１９９１年１月１日から１９９３年６月３０日までのクレームに基づいているものとする。この場合、Ａ＝１／１／９１、Ｃ＝６／３０／９３であり、Ｂは両日付のどこか間に、例えば１３／３１／０２に選択しても良い。一般に、Ａは日付抽出プロトコール（即ちデータが得られる

時点から）に基づいて定めて、Ｃについては会員が依然と登録されており給付金の受給資格を有する最終日で定める。言うまでもなく、本発明を実施するに当たっては、これ以外の定義付けの仕方を適宜選択することもできる。

【０１３９】現時点Ｂの定義が重要である。本発明にあっては、予測モデルの精度を最大化するためにＢについては二つの基本的定義を設けている。当業者には理解できるようにＢについて別の定義を利用することもできるけれども。

【０１４０】図１３は、スキーム１と称して、図８に示した事象レベルファイルからデータを処理するに当たって利用する典型的な時間ウィンドウスキームを示している。

【０１４１】スキーム１において、ＢからＣにかけて事象予測領域を設定することで、分析における全ての会員に対してＢ＝Ｃ－（ｘ＃ヶ月）としている。例えば６ヶ月ＣＨＦ入院（ＨＬ）モデル（即ち、ＨＬは従属変数として用いる）を構築する場合、Ｂ＝Ｃ－（６ヶ月）である。ジェーン・ドーの事例においては、Ｂは１２／３１／９２に等しいことになる。従って、ＡからＢまで（１／１／９１～１２／３１／９２）をカバーする日付だけを利用して、「次の６ヶ月」におけるＣＨＦを予測する。ここで言う「次の６ヶ月」とは、時点Ｂが「今時点」であり、その後の時点は将来にあり、その前の時点は過去にあることを含蓄している。これがスキーム１の基調概念であって、予測モデルの実施と運用について理解する上で重要なものである。

【０１４２】本発明の別の実施の形態としては、予測すべき事象の出現を反映する(reflectproximity to the event)分析重みを、例えば３ヶ月以内ｘ１、３－６ヶ月ｘ.７５、６－９ヶ月ｘ.５、９－１２ヶ月ｘ.２５、１２ヶ月以上ｘ.１２５として利用することもできる。当業者に知られている例えば負の重み付けの如くその他の適当な重み付け法を利用することもできる。例えば本発明の典型的な実施の形態では、実際に用いている重みファクターは$1/e^{-x}$であり、ここでのｘは各事象ごとにつき時点Ｂからの時間（月）を表す。

【０１４３】それ故、時間ウィンドウスキームと所定変数の適当な集合が与えられれば、処理ステップ６５０で分析ファイルが生成されるのである。

【０１４４】図８へ戻って、ステップ６５０において分析ファイルが生成されると、次のステップ６６０において、統計データを利用して分析ファイルを処理するステップ６６０が実行され、これで同定病症予測モデルが得られる。

【０１４５】分析ファイルを用いれば、統計学的技法を利用することで種々の識別ないし予測モデルを構築することができる。特に、会員のレベルにある分析ファイルをＳＡＳにおいて得られる統計的機能を用いて処理している。本発明の典型的な実施の形態においては、予測モデルを生成するために実行する統計処理は記号論理的多重回帰(multiple logistic regression)である。当業者には理解され得るように、本発明にあってはその他の統計学的技法を利用することもできる。

【０１４６】典型的な実施の形態においては、統計学的処理を分析ファイルに適用すると、当該処理で所定のレベルの重要度（確率値＜０.０５）を満たす変数が判別する。これらの変数は、算術式 $\mathrm{Logit}(p) = a + bx_1 + cx_2 \cdots + zx_i$（但し、ｘ１からｘｉまでは判別した変数、ａからｚまではこれらのパラメータの概算値を表す）で表される予測モデルを構築している。すると、考慮中の結果についての個々の確実性(ｐ)が、式 $p = e^{-\mathrm{logit}(p)}/(1 + e^{-\mathrm{logit}(p)})$ を用いることで求められる。

【０１４７】前述のステップを用いて幾つかの実験を行った。ある一つの実験においては、ＨＬ標識子を従属変数とし、全ての会員について(with all commercial members)のスキーム１に基づくモデルの結果を求めた。得られたＣＨＦによる健康悪化を最もよく予測しそうな独立変数は、(１)ＣＨＦによる入院、(２)ループ利尿薬－一日量(days supply)、(３)高血圧での入院－滞在期間、(４)ＣＨＦでの医者訪問、(５)ＭＩでの医者訪問、(６)ＡＣＥ抑制剤所持量(possession)（負の標識子）であった。

【０１４８】別の実験では、ＨＬ標識子を従属変数とし、ＣＨＦで以前に入院したことのない全ての会員についてのスキーム１に基づくモデルの結果を求めた。得られたＣＨＦによる健康悪化を最もよく予測しそうな独立変数は、(１)ループ利尿薬－一日量(days supply)、(２)ＣＨＦでの医者訪問、(３)ＩＨＤでの入院、(４)ＩＨＤでの医者訪問、(５)糖尿病での救急室訪問、(６)高血圧での入院－滞在期間、(７)生活様式での救急室訪問、(８)その他の心臓病での入院、(９)肺の状態での医者訪問、(10)貧血での医者訪問又は貧血での救急室訪問、(11)「その他」のＣＶ薬の処方(Rx)であった。

【０１４９】また別の実験では、ＨＬ標識子を従属変数とし、メディケード会員についてのスキーム１に基づくモデルの結果を求めた。得られたＣＨＦによる健康悪化を最もよく予測しそうな独立変数は、(１)ＣＨＦによる入院、(２)ループ利尿薬－一日量(days supply)、(３)ＣＨＦでの入院、(４)糖尿病での医者訪問であった。

【０１５０】スキーム１に代わるものとしてのスキーム２を図１４に示しているが、ここでは本発明で生成した事象レベルのファイルからデータを処理する際に利用する二番目の典型的な時間ウィンドウスキームを示している。

【０１５１】スキーム１とスキーム２との相違点は、少なくとも一つの同定病症での入院ないし救急室訪問（ＨＬ／ＥＲ）を有する会員に対する予測領域の定義付けが

異なっている点にある。時点Ｂから始まるスキーム２での予測領域は、各会員の記録を複数パスして定めている。前述のジェーン・ドーの事例における分析記録(1/1/92から6/30/93、A=1/1/91、C=6/30/93)に当てはめて時点Ｂを定めるに当たりスキーム２がどのように働くかを説明するが、その際、ジェーン・ドーはうつ病で３回、即ち、4/1/91、4/1/92、4/1/93に入院したものと仮定する。

【０１５２】時点Ｂは、最初の同定病症ＨＬ／ＥＲ-１ヶ月の日付、或いは会員のクレーム歴に同定病症ＨＬ／ＥＲがない場合では時点Ｃと等しくなるように設定されている。ジェーン・ドーの場合ではＢ＝4/1/91である。本発明の典型的な実施の形態にあっては、ＨＬ日から１ヶ月遡らせているが、これはモデルを利用する環境を模するためである。点数報告書(scoring report)に基づいて病症管理行為に対するモデルのスコアリング(scoring)から少なくとも３０日の遅れがある可能性が考えられる。ジェーン・ドーの事例ではＢ＝4/1/91-（１ヶ月）＝2/28/91となる。この場合でのジェーンの記録は、分析領域の時間間隔が２ヶ月だけしかない、即ち、通常データ歴に必要とされている６ヶ月よりも短いから、モデル構築には使えない。

【０１５３】次の（又は三回目ないしそれ以後の）ＨＬ日付を用いてステップ１とステップ２とを繰り返して時点Ｂを設定すると、ジェーン・ドーの記録は二回目と三回目のパスでモデル構築に組み込まれることになる。本発明の典型的な実施の形態では、このプロセスは、研究対象の中に５つかそれ以上の同定病症を有する人はあり得ないと考えられるから、３回ないし４回のパスで終結する。

【０１５４】尚、モデリングを繰り返した結果、別に独立変数を設定する煩わしさが増えることになる。しかし、スキーム２の重要な利点は、予測ＨＬ／ＥＲ率がスキーム１よりも大きいところにある。

【０１５５】更に別の実施の形態では、予測すべき事象の出現を反映する(reflect proximity to the event)分析重みを、例えば３ヶ月以内ｘ１、３－６ヶ月ｘ.７５、６－９ヶ月ｘ.５、９－１２ヶ月ｘ.２５、１２ヶ月以上ｘ.１２５として利用することもできる。当業者に知られているその他の適当な重み付け法を利用することもできる。このような重み付け法はスキーム１やスキーム２の何れとも利用できる。

【０１５６】尚、それぞれの実験の結果では特定の予測モデルに異なった数の独立変数が利用できることが示され、所望のモデルの精度に応じて、選択された従属変数を正確に予測する個々の能力に基づきそれ以上又はそれ以下の独立変数を用いることができる。

【０１５７】リスク階層化と介入リストの生成

次に、求めた予測モデルをクライアント特有のデータに適用する。求めたモデルは既存のデータや、定期的に更新されるデータ、或いは、その他の給付金プロバイダのその他のクレームデータベースに適用することができる。そのためには、興味のある求められた独立変数だけを処理すべきである。言うまでもないことではあるが、新たなクレームデータベースが分析されるにつれて、他の変数がよりよい予測子になり得るかを判定するために、全てのプロセスが繰り返されて新たなモデルが生成される。

【０１５８】モデルを適用することで発生した出力は、患者の健康状態が悪化しかねない兆しを表す標識子（即ち、従属変数で定められた経験）が示す同定病症を有する全ての患者のリストを含むファイルである。このリストは、健康状態悪化の可能性が５％もしくは１０％ごとに大きくなるとか、可能性の増分に応じてサブグループ化しても良い。

【０１５９】モデルの性能については、各５％ないし１０％増分サブグループごとの予測ウィンドウに発生する実際の健康悪化の可能性の指摘(actual adverse health outcomes)の数を求めることにより評価できるようになる。

【０１６０】前述したように同定病症患者のデータベースないし将来のクレームデータにモデルを適用するか、新データベースに新モデルを構築することにより、同定病症の可能性が大きい患者を同定できるから、種々の介入を施すことにより当該患者に対する健康管理リソースの効果的な割当てを最大化することができる。リスク階層化（ＲＳ）プロセス１４０は、そのような患者のリストを生成するために必要なものであり、介入管理プロセス１６０はこれらのリストを取り込んで同定病症の患者に対して介入を開始させるようになっている。これらのプロセスについて以後詳述する。このような介入は1)特定の症例管理、2)サブグループの特性に基づいた新規介入、3)高リスク介入、4)（相対的）高コスト介入、5)言うまでもなく医学安全指針に則る計画改善の何れかの形を取ることがある

【０１６１】図２において、リスク階層化（ＲＳ）プロセス１４０は、介入管理プロセス１６０に同定病症で健康悪化の可能性のある患者のリストを供給することにより病症管理システムに対応している必要がある。この間者のリストを介入リストと呼ぶ。

【０１６２】図１５に、ＲＳフロントエンド１１１０モジュールと、ＲＳマイニングエンジン(mining engine)（ＭＥ）１１１２モジュールと、ＲＳデータベース１１１８とからなるリスク階層化プロセス１４０の高レベルフローチャートを示す。これらの二つのモジュールは協働してＲＳデータベース１１１８から介入リストを出力する。

【０１６３】ＲＳフロントエンド（ＦＥ）１１１０は、末端ユーザーをして、患者の病症プログラムを走らせたり、維持するのに必要な情報の入力ができるようにして

いる。
【０１６４】本発明のＲＳフロントエンド１１１０は、３２ビットソフトウェア開発ツールであるデルフィ2.0を用いて書かれている。このＲＳフロントエンド１１１０は、ウィンドウズＮＴまたはユニックスサーバー上で走るサイベース(Sybase)システムに患者と病症のパラメータを記憶させる。このＲＳフロントエンド１１１０では、ボーランド社製３２ビットサイベースＳＱＬリンクなるデータベースドライバーを利用している。しかし、本発明はその他の類似の開発及びデータベースツールを用いて実施することもできるものであるから、前述のツールに限定されるものではない。
【０１６５】ＲＳマイニングエンジン１１１２は割り当てられた(scheduled)クライアント同定病症プログラムを走らせて、図２の介入管理プロセス１６０に供給する介入リストを生成する。このＲＳマイニングエンジン１１１２は、下記の基本的なプログラム論理を有するバッチないしダイモンプロセスである。
【０１６６】Ａ．毎晩（バッチ）又はダイモンプロセスとして立ち上げる。
Ｂ．スケジュールと入手可能なデータに基づき、走らせるのに必要なクライアント同定病症プログラムを判定する。
Ｃ．予定されているクライアント病症プログラムにつき、
a)病症プログラムルールコンポーネントを獲得。
b)各ルールコンポーネントごとに病症プログラムパラメータを獲得。
c)同定症状プログラムに必要なデータストリーム（Rx、Mx及びラボ）があることを有効化する。
d)予定されているクライアント同定病症プログラムを初期化する。
e)予定されているクライアント同定病症プログラムを実行する。
f)介入管理プロセス１６０に介入リストを供給する。
Ｄ．終了（バッチ）又は、スリープに設定（ダイモン）
【０１６７】ＲＳマイニングエンジン１１１２は、３２ビットソフトウェア開発ツールであるデルフィ２.０を用いて書かれている。このＲＳマイニングエンジン１１１２はＲＳフロントエンド１１１０からクライアント薬局クレーム、医学クレーム及び特定病症プログラムのためのラボ検査情報と組合わさって出された病症パラメータを処理して、特定の介入リストを出力するが、これら全てのリストはリレーショナルデータベースから検索されたり、記憶されるようになっている。ＲＳマイニングエンジン１１１２は、ウィンドウズＮＴまたはユニックスサーバー上で走るサイベースシステム１１データベースを利用している。また、このＲＳマイニングエンジン１１１２では、ボーランド社製３２ビットサイベースＳＱＬリンクなるデータベースドライバーが使われている。しかし、本発明はその他の類似の開発及びデータベースツールを用いて実施することもできるものであるから、前述のツールに限定されるものではない。
【０１６８】図１５に示したリスク階層化プロセスの動作について詳述する。図２の症例管理プロセス１５０か、又は別の実体と連携する末端ユーザーは、先ずＲＳフロントエンド１１１０に末端ユーザー同定病症プログラム情報を入力する。するとＲＳフロントエンドは新たな同定病症のセットアップのための情報や、新たな病症プログラム、予測モデルとルール、クライアント特定パラメータ、病症特定ルールパラメータ、それに、新たなクライアントを記憶し、このＲＳフロントエンド１１１０が病症プログラムをクライアント、スケジュール病症プログラムとに連合させて情報レポートを走らせる。ＲＳフロントエンド１１１０はこの情報を、ＲＳマイニングエンジン１１１２が用いているフォーマットで「病症プログラム」として記憶する。
【０１６９】病症プログラムはＲＳフロントエンド１１１０によりＲＳデータベース１１１８に供給されるが、このＲＳデータベース１１１８には予測モデリングプロセス１３０から予測モデルとルール情報も取り込まれている。最後に、ＲＳマイニングエンジン１１１２が患者データに予測モデルを当てはめると、病症管理データベース１２０から患者医学情報がＲＳマイニングエンジン１１１２のためのＲＳデータベース１１１８に供給される。最後に、ＲＳマイニングエンジン１１２は、ＲＳマイニングエンジンが病症プログラムを実行して予測モデルを患者データに当てはめるにつれて、ＲＳデータベース１１１８に含まれている情報を取り込む。
【０１７０】図１６は、本発明のリスク階層化プロセスのＲＳマイニングエンジン１１１２を示す高レベルのフローチャートである。図１６に示したＲＳマイニングエンジン１１１２は、ＲＳスケジュールマネジャー（ＳＭ）１２１０とＲＳルールマネジャー（ＲＭ）１２１４とＲＳ介入リストマネジャー（ＩＬＭ）１２１６の三つの重要なサブシステムで構成されている。各サブシステムは、図２の病症管理データベース１２０の部分集合であっても良い、クライアント及び同定病症プログラム分析環境(client and identified disease program analytic configurations)を含むＲＳデータベース１１１８と互いに作用しあっている。
【０１７１】病症管理データベース１２０は、各クライアントごとの患者情報（会員、資格、薬局（Rx）クレーム、医学（Mx）クレーム、臨床ラボ（Ｌａｂ）クレーム）で定期的に更新されている。従って、ＲＳデータベース１１１８も、クライアント及びクライアント会員情報で定期的に更新されている。ＲＳマイニングエンジン１１１２は、病症プログラム分析ルールで処理すべき適当なクライアント患者情報を病症管理データベース１２０から収集している。本発明の典型的な実施の形態にお

いては、全てのリレーショナルデータベースはサイベースシステム１１である。

【０１７２】ＲＳスケジュールマネジャー１２１０同定病症プログラムのリストをコンパイルして、プログラムを実行する予定時刻が到達したかどうかを確認するために各登録クライアントを調査することで実行する。また、クライアント病症プログラムは、スケジュール化されるに先立ってＲＳマイニングエンジン１１１２での実行に備えて認められているものでなければならない。このように承認するに当たっては、全ての病症プログラムパラメータが入力されていること、それに、入力されているデータがＲＳフロントエンド１１１０により有効化されていて、ＲＳマイニングエンジン１１１２で処理できる状態にあることを明確にしている必要がある。最後に、ＲＳスケジュールマネジャー１２１０が、必要なデータストリームが全て得られることを確認する。ＲＳマイニングエンジン１１１２としては、定期的に実行されるバッチプログラムであっても良い。前述の論理により選択され各同定病症プログラムごとにＲＳルールマネジャー対象が生成される。ＲＳルールマネジャー対象は順次実行される。

【０１７３】その後、ＲＳルールマネジャー１２１６は特定の同定病症プログラムを順序づけしたシーケンス(ordered sequence)で実行するため位に必要なルールを構築する。これらのルールについては後ほどに詳述するが、予測モデリングプロセス１３０と症例マネジャー１５０により出されるものである。各ルール対象は病症プログラムとクライアント特有ルール引数で初期化される。ルールシーケンスとしては、一つかそれ以上の共通ルールと、患者群分類子（ＰＧＣ）と呼ばれる一つかそれ以上のルールのシーケンスを含んでいるのが望ましい。ＰＧＣは、特定の基準に基づいて介入ないし報告するために特定のグループに狙ったクライアント患者群(targeted client patient population)を層状化するのに用いられる。全ての介入と報告は症状プログラムＰＧＣのどれか一つ又はそれ以上における患者メンバーシップの基づいて実施される。

【０１７４】共通ルールはＰＧＣに先立って特定の順序で実行される。一般にこれらのルールは、ルールで他のルール（クライアント関与、Rxクレーム、Mxクレームなど）のための環境が用意されるか、又は、他の複合ルール（患者生存(Patient Active)、患者年齢、患者性別など）により作用されるに先立って全体の患者セット容量を減少させて全体の性能を向上させる除外作用を行うことから、共通ルールと称している。特定のルールに「適っていない」患者は、患者セットから除外される。

【０１７５】ＰＧＣは、共通ルールにより提供される患者セットに対して並列処理される各ＰＧＣにおけるルールと並列実行される。ＰＧＣルールは、セットにおける各患者に対して符号計数機構(tally mechanism)を用いて、その患者が特定のルールを通ったか、逸れたかを示すようになっている。

【０１７６】全てのＰＧＣが終了すると、ＲＳ介入リストマネジャー１２１６が各ＰＧＣにおけるメンバーシップのために各患者のスコアを取る。するとＲＳ介入リストマネジャー１２１６は介入管理プロセス１６０における後での処理のための介入リストを生成して保存する。

【０１７７】ＲＳスケジュールマネジャー１２１０は先ず、バッチプロセスの起動時に、或いは、ダイモンとして実行している場合は周期的にＲＳデータベース１１１８にアクセスして、承認されたクライアント同定病症プログラムの実行予定日(approved client identified disease programs scheduled run date)が到達したかどうか、また、全ての必要なクライアントデータストリームが更新されているかどうかを判断する。全ての必要なデータストリームが得られるのであれば、ルールマネジャー（ＲＭ）対象が各クライアントと病症プログラムごとに生成される。

【０１７８】同定病症プログラム属性はテーブルに保存してある。一つの属性は承認ステータスである。好ましくは各同定病症プログラムが予定に組み込まれる前に承認されているのが望ましい。何らかの同定病症プログラムが予定されているのであれば、当該病症プログラムの承認が無効になるようなことはない。

【０１７９】どのプログラムをいつ実行すべきかの判断は、それ以外のパラメータを有するものの、その中でもステータスと実行予定日を含むスケジュールテーブルを介して行われる。

【０１８０】ＲＳルールマネジャー１２１４は、単一の病症プログラムを実行し、管理する役を担っている。

【０１８１】ルールは、それに対して割り当てられた患者群分類子（ＰＧＣ）に従ってグループ分けされている。第一に、共通ルール（ＰＧＣのないもの）が実行され、その後、病症プログラムにある各ＰＧＣが実行される。

【０１８２】ＲＳ介入リストマネジャー１２１６は、首尾良く実行できた各クライアント病症プログラムを評価して、そのプログラム内の各ＰＧＣに属するものとして当該プログラムにより選択された会員の介入候補テーブルにおけるリスト作りを編集する。

【０１８３】会員がどの共通ルールによるセットから削除されていないのであれば、当該会員はＰＧＣに組み込まれ、かくて各ＰＧＣルールに対する会員の出力が所望値（非否定ルールには１、否定ルールには０）に一致する。

【０１８４】ＰＧＣに含まれた会員は、介入リストともなる介入テーブルに入れられる。このテーブルには、選ばれた会員の識別情報と、プログラム実行と、会員が含まれているＰＧＣと、医師識別ルールが使われた場合に識別される医師が含まれている。

【０１８５】ルール － 一般的分類
「根幹ルール(Root Rule)」として分類されたルールは、他の全てのルールに先立って実行する必要のあるルールを表していて、他の全てのルールにためにある環境の初期化を行う。同定病症プログラムはどれも、一つだけの根幹ルールを有している必要がある。現に、この一つだけの根幹ルールは、クライアント関与(Client Participation)である。
【０１８６】「共通ルール」として分類されたルールは、ＰＧＣに先立って実行され得るルールを表している。共通ルールから「落ちこぼれた(fail)」会員は患者セットから除外される。ルールは共通ルールとして、また、ＰＧＣルールとして同時に実行され得る。
【０１８７】「ＰＧＣルール」として分類されたルールは、共通ルールの後に並列実行され得るルールを表している。ＰＧＣルールを「通過した(pass)」会員は、テーブルにおけるそのルールのために特に追加されたカラムにマークされる。ルールは共通ルールとして、また、ＰＧＣルールとして同時に実行され得る。
【０１８８】「薬局クレーム生成(Creates Pharmacy Claims)」なるルールは、薬局クレームのためのテーブルを生成する。データソースに薬局クレームを用いる同定病症プログラムはどれも、薬局クレームを用いるルールに先立ってこの機能を実施できるルールを有しているのが望ましい。
【０１８９】「医学クレーム生成(Creates Medical Claims)」なるルールは、医学クレームのためのテーブルを生成する。医学クレームを用いる同定病症プログラムはどれも、医学クレームを用いるルールに先立ってこの機能を実施できるルールを有しているのが望ましい。
【０１９０】「臨床検査データ生成(Creates Clinical Test Data)」なるルールは、臨床検査データのためのテーブルを生成する。ラボクレームを用いる病症プログラムはどれも、ラボクレームを用いるルールに先立ってこの機能を実施できるルールを有しているのが望ましい。
【０１９１】「専門利用(Use Specialties)」なるルールは、医者の専門情報を利用する。
【０１９２】「薬局クレーム利用(Uses Pharmacy Claims)」なるルールは、薬局クレーム情報を含むテーブルを利用する。
【０１９３】「医学クレーム利用(Uses Medical Claims)」なるルールは、医学クレーム情報を含むテーブルを利用する。
【０１９４】「臨床検査データ利用(Uses Clinical Test Data)」なるルールは、臨床検査情報を含むテーブルを利用する。
【０１９５】ＲＳマイニングエンジン１１１２における全てのルール対象は、全てのルールが共有するある基本的機能構造をもたらす共通の先祖から下っている。
【０１９６】ルール － 選択ルールと介入ルール
ＲＳマイニングエンジン１１１２のここでの実施の形態は、種々の選択及び介入ルールをサポートしている。
【０１９７】１）クライアント関与ルール(Client Participation Rule)
患者が病症管理プログラムに登録されたグループの一員かどうかを表す識別子。このルールで、次のルールにより考慮される全ての患者が、クライアントが当該プログラムに関与したがっているグループの一員であることがはっきりする。このルールで、患者の給付金構造(benefit structure)からして病症プログラムが適切に機能することが確認できる。クライアント関与は現在のところ唯一の根幹ルールである。従って、病症プログラムでは最初のルールであるのが望ましい。これは常に共通ルールとして実行される。
【０１９８】２）Rxクレームルール(Rx Claim Rule)
このルールで単一の同定病症プログラムの実行に適用し得る全ての薬局クレームデータを選択する。特定の分析時間枠内での特定の薬グループのために選択された薬局処方クレームを定める。Rxクレームルールは常に共通ルールである。通常、与えられたプログラムで一回実行されるのみである。
【０１９９】３）特定薬の存在ルール(Existence of a Specific Drug Rule)
このルールは、ルールの時間枠内での特定の薬グループにおける少なくとも一つの薬のクレームで会員を識別する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２００】４）再発患者ルール(Recurrent Patient Rule)
このルールは、患者が病症について複合独立エピソード（再発性）の可能性を示す服薬パターンを持っているかどうかを識別する。このルールで、特定の薬治療の離散エピソードを少なくとも幾つか有している患者を選択する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２０１】５）現治療法停止ルール(Stoppage in Current Therapy Rule)
このルールは、特定の薬グループに対しての薬治療を停止すべき患者を識別する。これは、その薬グループでの薬の最終処方に基づいて判定する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２０２】６）患者年齢ルール(Patient Age Rule)
このルールは、特定のターゲット範囲内に該当する年齢の患者を識別する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２０３】７）最低患者資格ルール(Minimum Patient Eligibility Rule)
このルールは、患者には特定の連続期間に亙り医学ないし投薬給付金を受ける資格があるかどうかを識別する。このルールは共通ルールか、ＰＧＣルールの何れかで実

行し得る。
【０２０４】８）患者生存ルール(Patient Active Rule)
このルールは、会員が生きているいて、介入時にプログラムに含ませるべきグループにあることを証明する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２０５】９）平均パフ当量ルール(Average Puff Equivalence Rule)
このルールは、会員が特定の時間枠の間に薬治療の所要平均パフ当量を有しているかどうかを識別する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２０６】１０）出来事回数ルール(Count of Occurrences Rule)
このルールは、患者に特定の薬治療について異なった規定日(filled dates)に選択範囲の出来事があったかどうかを識別する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２０７】１１）患者性別ルール(Patient Gender Rule)
このルールで、特定性別の会員を識別する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２０８】１２）服用量繰返しルール(Dose Level Recurrence Rule)
このルールは、同一又は類似の重さの病症についての複合独立エピソード（再発性）の可能性を示す特定の服用量範囲での服薬パターンを持っているかどうかを識別する。このルールで、特定の薬治療の離散エピソードを少なくとも幾つか有している患者を選択する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２０９】１３）所要服用量での連続治療のルール(Continuous Therapy at Required DoseLevel Rule)
このルールは、特定の期間に亙って特定の服用量範囲での連続薬治療を受けている患者を識別する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２１０】１４）併用治療ルール(Concurrent Therapy Rule)
このルールは、特定の薬グループについて少なくとも所定期間に亙り重複した治療を受けている患者を識別する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２１１】１５）服用量ルール(Dose Level Rule)
このルールは、特定の服用量範囲で特定の薬治療のRxクレームを有する患者を識別する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２１２】１６）薬使用量ルール(Drug Usage Level Rule)
このルールは、期待値(expected values)に対する薬使用量が所定範囲にある会員を識別する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２１３】１７）特定薬の加重存在ルール(Weighted Existence of Specific Drug Rule)
このルールは、薬治療が指定のリスク点数範囲にある会員を識別する。各薬治療にはリスク点数が割り当てられていて、患者の累積リスク点数を判別するに当たっては、会員の薬歴を評価する。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２１４】１８）医者識別ルール(Physician Identification Rule)
このルールは、介入すべきと認定して会員についての連絡を送る特定の処方作成者(prescriber)を選択する。この選択は、その会員に対する薬局クレームと、患者データ書庫１２０にある会員データから見出される会員の主治医についての情報との何れか一方、又は両方に基づいている。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２１５】１９）全会員ルール(All Member Rule)
全会員ルールは、記録集合にある全ての会員を選択する。共通ルールで選択された全ての会員を含むＰＧＣをサポートするのに使われる。また、このルールは、ある種の病症プログラムの最適化をサポートするためにＲＳマイニングエンジン１１１２により内部で利用される。このルールは共通ルールか、ＰＧＣルールの何れかで実行し得る。
【０２１６】付帯書類ＶＩには、本発明の好ましい実施の形態で用いられている如くの選択ルールのリストとその説明書が含まれている。これらのルールは当業者には改変したり、削除したり、本発明の特定の実施のために新たに追加することも容易である。
【０２１７】介入管理プロセス
もう一度図２へ戻って、リスク階層化プロセス１４０は、特定の介入を実施するために介入リストを介入管理プロセス１６０に出力する。介入には、介入リストにあげられている会員患者に対する最初の申し出、病症プログラムの完全実施、教材の送付、内線ないし外線電話通信、ファックス交信、Ｅ－メール交信、音声応答交信などがある。介入管理プロセス１６０で、介入記録追跡プロセス１７０に介入情報が送られ、それで病症管理サービスを施すことで特定の病症の結果を向上させることができるかどうかを判定するために介入を記録する。
【０２１８】図１７は、本発明の介入管理プロセス１６０の高レベルの図であり、介入プログラムと呼ぶ介入プロセスは同定病症を有するクライアント会員の介入リストに基づいて実施される。図１７に示した介入管理プロセス１６０には、介入プログラムを開始するプログラム実行１３１０と、同定患者を介入プログラムに登録する登録１３２０と、登録患者に対する介入を実行する介入１３３０と、患者に対する介入の結果を分析する分析１３４０とが含まれている。

【０２１９】介入管理プロセス１６０には、病症管理データベース１２０からデータが、また、リスク階層化プロセス１４０から介入リストが供給される。このデータ供給ないし検出プロセスには病症プログラムに関与する条件を満たした特定の患者を識別するパラメータが備わっている。この検出プロセスで、下記の条件で特定の病症プログラムにおいて考慮する個体群(population)が得られる。

【０２２０】１）病症管理データベース１２０が予定通り介入管理システムにクライアントの更新された同定病症患者データを供する。

【０２２１】２）介入記録追跡プロセス１７０が病症管理データベース１２０に介入接触データを送り返す。この介入データは分析プロセスでの利用に備えてそこに保存される。

【０２２２】３）介入管理プロセス１６０が、新たな登録者と認定された「追加(”add”)」による新たな介入データや、病症検出とその後の診断の変動、又は、介入マネジャーからの個々の登録要請を検出して選択すると共に、パスする。

【０２２３】４）介入記録追跡プロセス１７はプログラムのために以前に選択された人たちについての患者データを取り込む。個人的な又は医学データに変化が生じた場合、データ修正が行われる。例えば、別に医学的ないし薬局クレームが取り込まれるか、又は、別のラボ報告が確保される。

【０２２４】図１７において、プロセスの最初のステップはプログラム実行ステップ１３１０である。このプログラム実行は、予め定められている基準に従って患者群を選択するプロセスにより病症プログラムが実施されて最初の介入が提供されるプロセスである。選択に伴って、特定の所定プログラム活動が行われる。

【０２２５】一例としての実行内容としては下記のことが考えられる。1)患者がプログラムに組み込まれたこと、病症プロトコール、それに、医者が奨める行動などを知らせる手紙が患者に代わって当該医者に送られる。2)介入管理データが病症管理データベース１２０から介入管理システムに１６０にパスされてロードされる。3)医者の手紙が送付されたことを表す最初の「接触セグメント(contact segment)」が患者のために追加される。

【０２２６】もう一つの一例としての実行内容としては下記のことが考えられる。1)病症プログラムに組み込まれたことを知らせる医者の手紙が患者に送付されると共に、その写しが医者にも送付される。2)患者が、音声応答システムを介して特定の質問に返答するように要請される。3)接触が追加され、将来の処理に備えて返答が分析される。

【０２２７】プロセスの次のステップは登録ステップ１３２０である。このステップでは、患者がプログラムに登録される。患者は、介入管理システムとのインターフェースを介して病症管理サービスに登録される。これらのインターフェースは音声応答システムであっても良いし、或いは、書面による返事、直接呼び出しであっても良い。登録プロセスで、介入管理システムでの介入事象のスケジュール立てが開始する。

【０２２８】その次のステップは介入プロセス１３３０であって、これは、1)治療コースとのコンプライアンスを保証し、2)患者と医者とに病症教材を提供し、3)遠方から緊急援助を差しのべ、3)各介入を「接触」として日誌に記入することで、プログラムの有効性の判定材料とすると共に、プログラムに対する中間調整を行う枠組を確立し、4)プログラムの有効性についてプロダクトマネジャーにデータを送り返すのを目的として、医者とクライアントとに仲立ちするプロセスである。

【０２２９】最後のステップは分析プロセス１３４０であって、病症管理サービスが成功したかどうかを判定するために、病症情報を同化する。介入管理システムは分析報告を出すようなことはしないが、このプロセスの最中に非常に重大(critical)な情報が処理に備えて病症管理データベース１２０に戻される。

【０２３０】ここまで典型的な実施の形態について本発明を詳述したが、本発明は、添付の請求の範囲に含まれる改変を施して実施されることもあり得る。

【図面の簡単な説明】

【図１】　本発明の病症管理システムの高レベルの図。

【図２】　本発明の病症管理システムの典型的な全体プロセスを示す高レベルのフローチャート。

【図３】　本発明の生患者データ獲得、予備処理、データベース形成を示す高レベルフローチャート。

【図４】　本発明で利用するに適した三つの典型的な情報源を示す高レベルのブロック図。

【図５】　本発明の生患者データ予備処理プロセスにおける変換プロセスの一実施の形態を示すフローチャート。

【図６】　本発明の一実施の形態における病症管理データベースで用いられている如くの典型的なデータモデルを示す図。

【図７】　本発明の典型的な実施の形態における研究データベースに含まれる記録のRx、ＤＲ、ＨＬクレームのそれぞれの研究データベースフォーマットを示す図。

【図８】　本発明の同定病症のための抽出プロセスと予測モデリングプロセスを示す図。

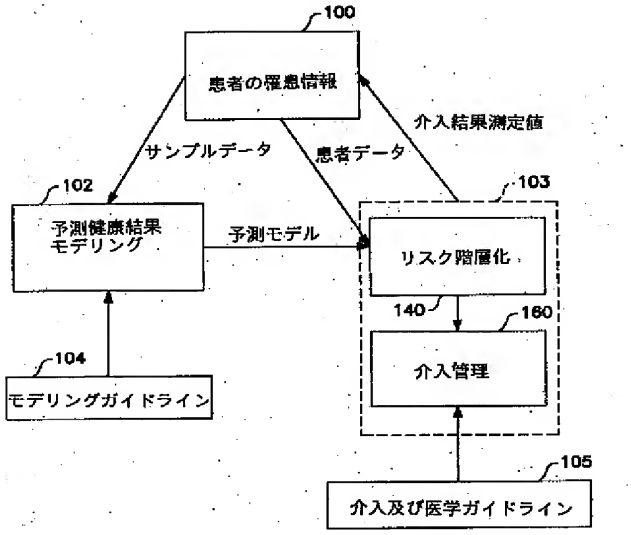
【図９】　同定病症がうつ病である場合に生成される、本発明の一実施の形態による事象レベルファイルを示す図。

【図１０】　同定病症が充血性心不全である場合に生成される、本発明の一実施の形態による事象レベルファイルを示す図。

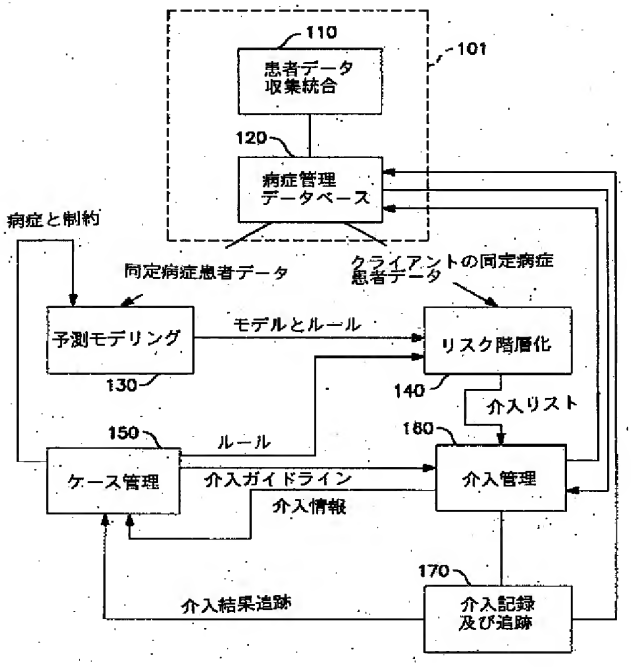
【図１１】　同定病症の場合での本発明に一実施の形態による分析ファイルのフォーマットを示す図。

【図１２】　本発明で利用する事象及び予測ウィンドウスキームを示す時間軸図。
【図１３】　図９と図１０とに示した事象レベルファイルからデータを処理するのに用いるのに適した一つの典型的な時間ウィンドウスキームを示す時間軸図。
【図１４】　図９と図１０とに示した事象レベルファイルからデータを処理するのに用いるのに適したもう一つの典型的な時間ウィンドウスキームを示す時間軸図。
【図１５】　同定病症の介入リストを生成する、フロントエンドプロセスとマイニングエンジンプロセスとを含む本発明のリスク階層化プロセスを示す高レベルのフローチャート。
【図１６】　本発明のリスク階層化プロセスのマイニングエンジンを示す高レベルのフローチャート。
【図１７】　本発明の介入管理プロセスの高レベルの図。
【符号の説明】
１００　患者の罹患情報データベース
１０２　予測健康結果モデリングプロセス
１０３　危険状態患者への介入プロセス
１０４　モデリングガイドライン
１０５　介入及び医学的ガイドライン
１２０　病症管理データベース
１４０　リスク階層化プロセス
１６０　介入管理システム。

【図１】



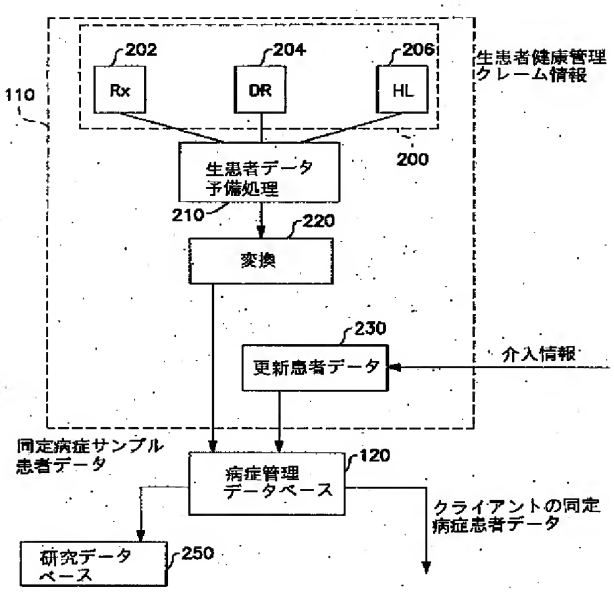
【図２】



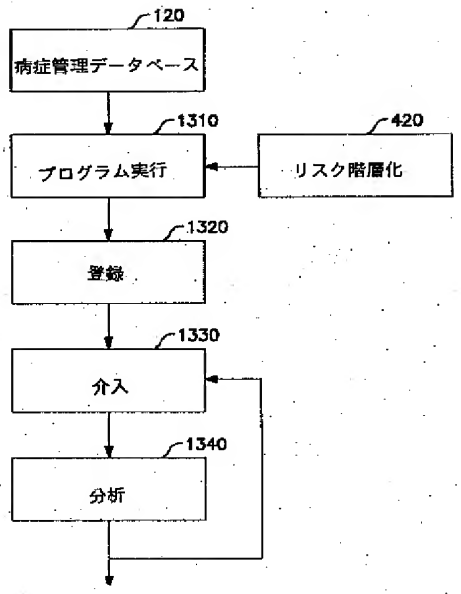
【図９】

	事　象	事象発生日	数	費用	カテゴリー識別子
1	うつ病で入院	日付	ＬＯＳ	$	重症度
2	うつ病で救急室	日付	ブランク	$	ブランク
3	うつ病で医者（外来患者）訪問	日付	ブランク	$	専門医
4	SSRIの処方	日付	毎日投与	$	治療クラス
5	TCAの処方	日付	毎日投与	$	治療クラス
6	その他神経活性薬の処方	日付	毎日投与	$	サブクラス
7	うつ病処置	日付	ブランク	$	サブクラス
8	非うつ病で入院	日付	ＬＯＳ	$	重症度
9	非うつ病で救急室	最初日	月数	$	
10	非うつ病で医者（外来患者）訪問	最初日	月数	$	
11	関係薬の処方	最初日	月数	$	
12	非うつ病薬の処方	最初日	月数	$	
13	うつ病でない処置	最初日	月数	$	重症度識別子

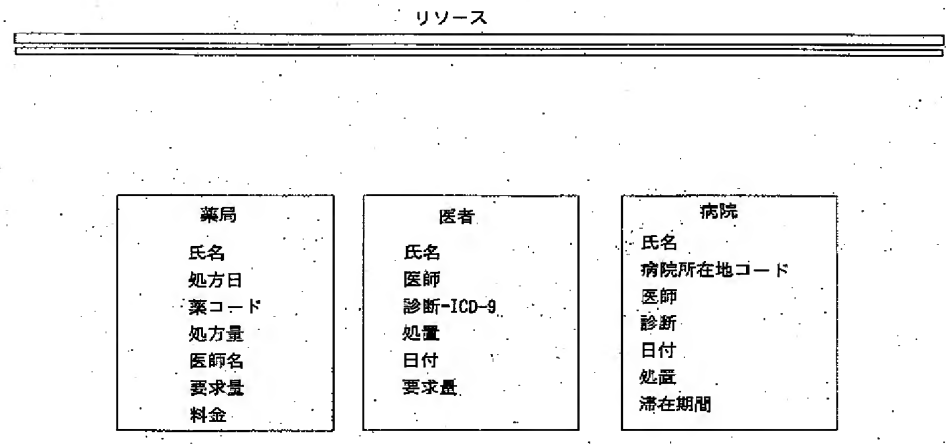
【図３】


202
204
206
Rx
DR
HL
生患者健康管理
クレーム情報
110
200
生患者データ
予備処理
210
220
変換
230
更新患者データ
介入情報
同定病症サンプル
患者データ
病症管理
データベース
120
クライアントの同定
病症患者データ
研究データ
ベース
250

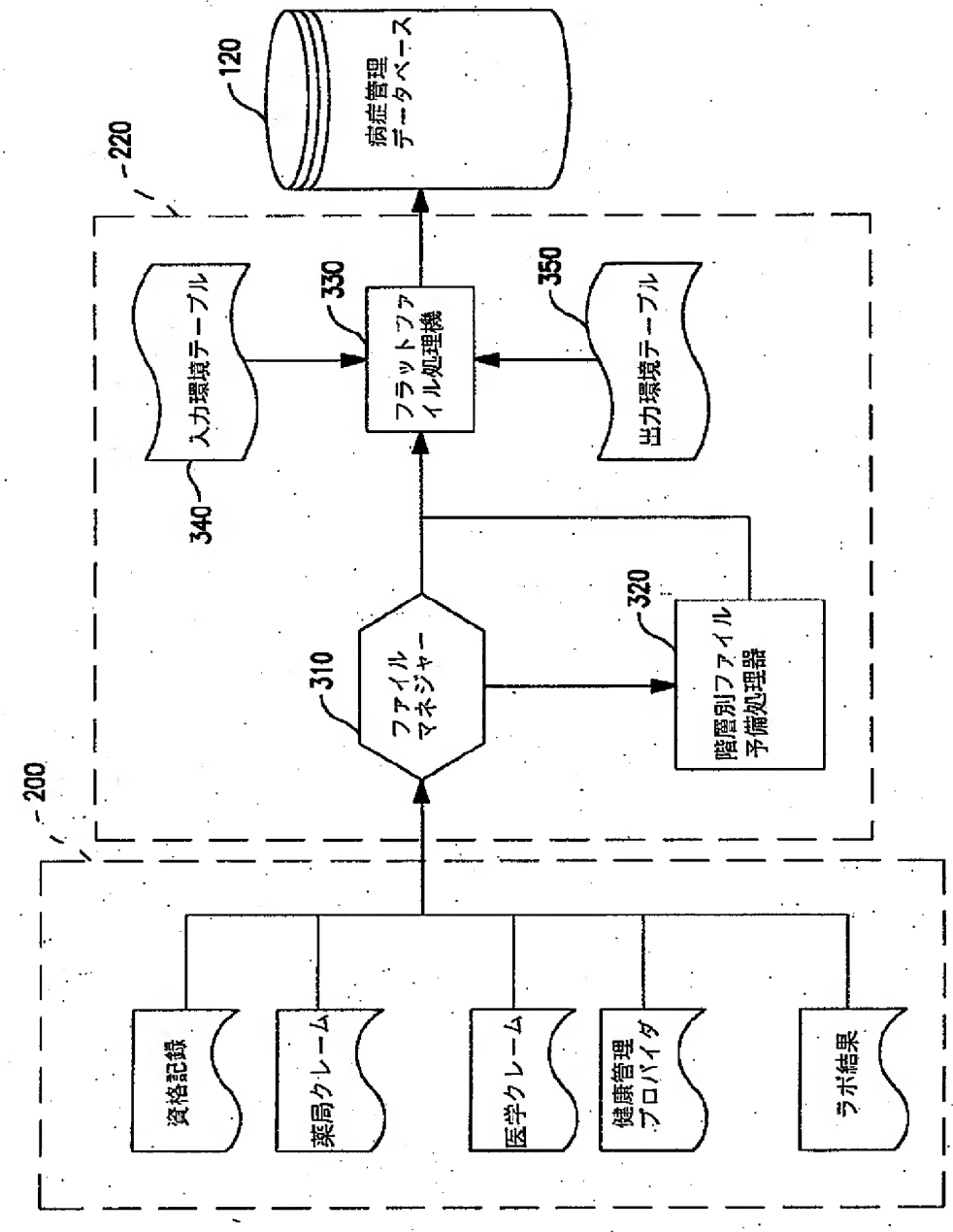
【図１７】


120
病症管理データベース
1310
プログラム実行
420
リスク階層化
1320
登録
1330
介入
1340
分析

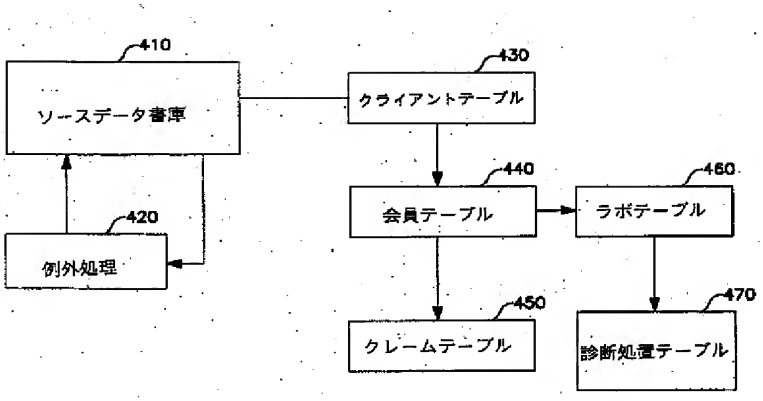
【図４】


リソース
薬局
氏名
処方日
薬コード
処方量
医師名
要求量
料金
医者
氏名
医師
診断-ICD-9
処置
日付
要求量
病院
氏名
病院所在地コード
医師
診断
日付
処置
滞在期間

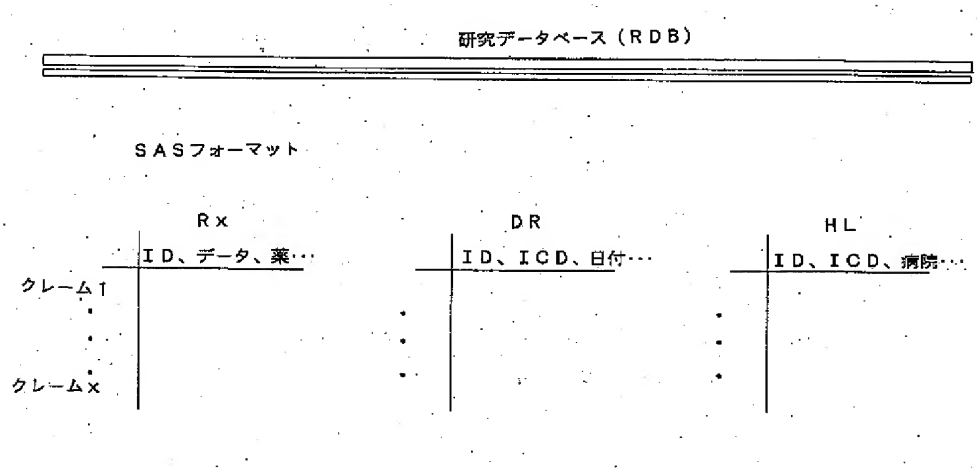
【図5】


120
病症管理
データベース
220
330
フラットファイル処理機
350
出力環境テーブル
入力環境テーブル
340
310
ファイル
マネジャー
320
階層別ファイル
予備処理器
200
資格記録
薬局クレーム
医学クレーム
健康管理
プロバイダ
ラボ結果

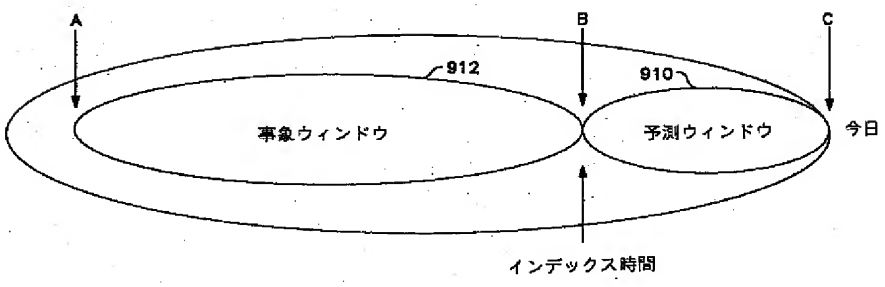
【図６】


410
ソースデータ書庫
430
クライアントテーブル
440
会員テーブル
460
ラボテーブル
420
例外処理
450
クレームテーブル
470
診断処置テーブル

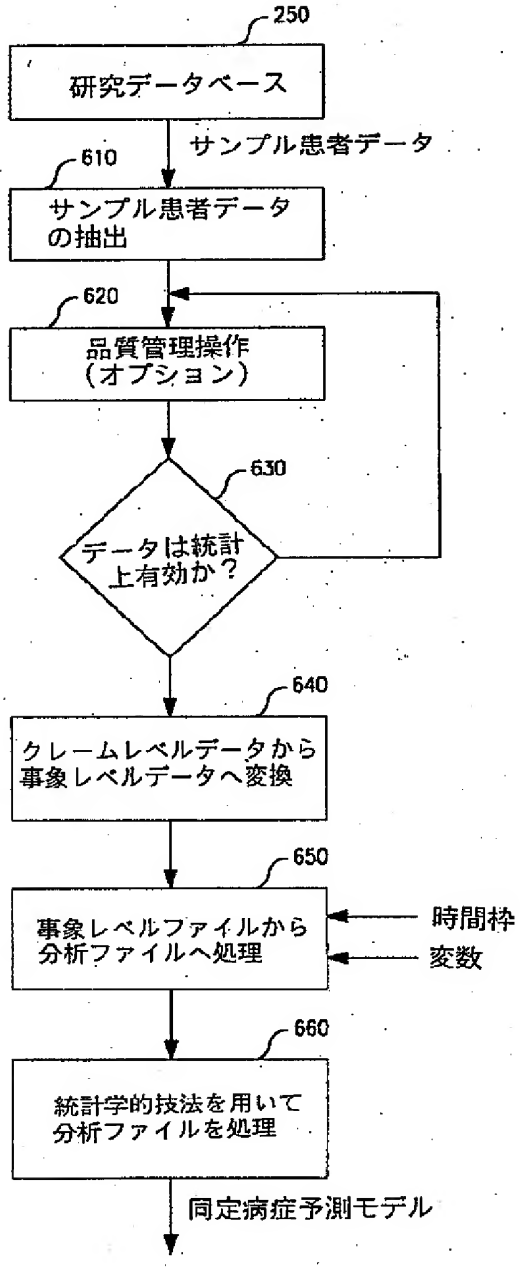
【図７】


研究データベース（ＲＤＢ）
ＳＡＳフォーマット
Ｒｘ
ＩＤ、データ、薬…
ＤＲ
ＩＤ、ＩＣＤ、日付…
ＨＬ
ＩＤ、ＩＣＤ、病院…
クレーム１
クレームｘ

【図１２】


A
B
C
912
910
事象ウィンドウ
予測ウィンドウ
今日
インデックス時間

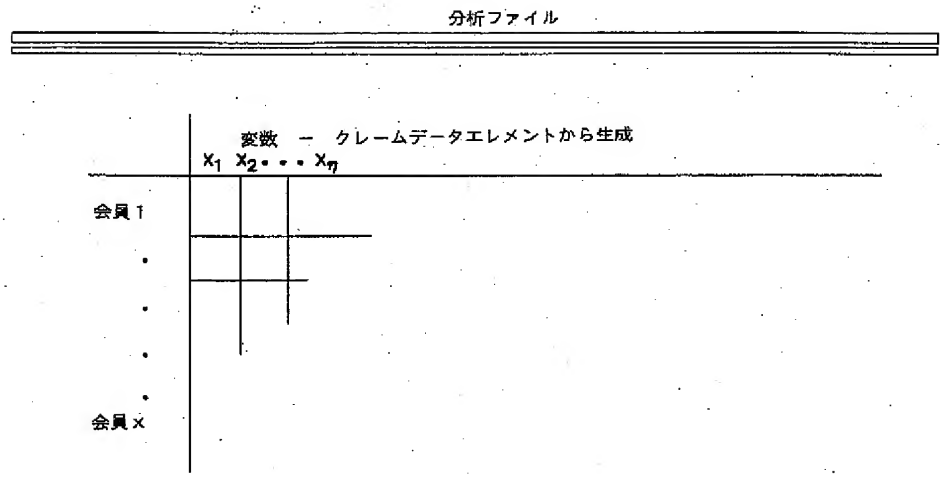
【図８】



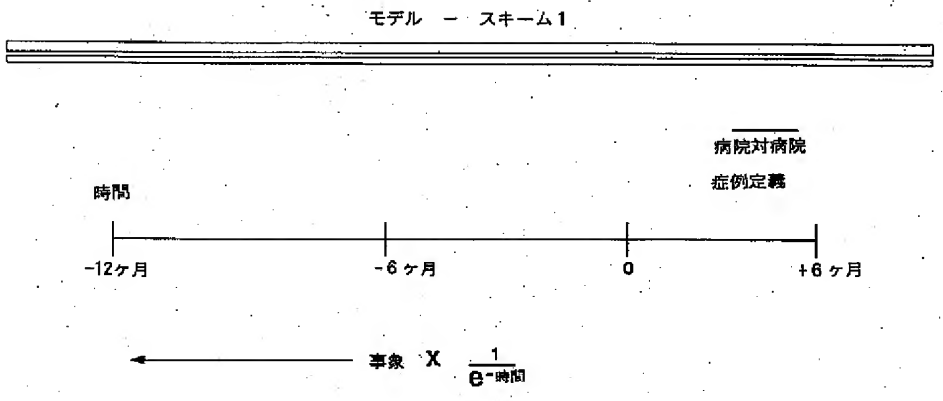
【図１０】

	事象	事象発生日	数	費用	カテゴリー識別子
1	CHF ER	日付	NA	$	NA
2	CHF 入院	日付	LOS	$	NA
3	CHF 事務所訪問	日付	NA	$	NA
4					
5	IHD入院	日付	LOS	$	サブクラス
6	IHD事務所訪問	日付	NA	$	サブクラス
7	糖尿病ER	日付	NA	$	NA
8	糖尿病入院	日付	LOS	$	NA
9	糖尿病事務所訪問	日付	NA	$	NA
10	不整脈ER	日付	NA	$	NA
11	不整脈入院	日付	LOS	$	NA
12	不整脈事務所訪問	日付	NA	$	NA
13	高血圧ER	日付	NA	$	NA
14	高血圧入院	日付	LOS	$	NA
15	高血圧事務所訪問	日付	NA	$	NA
16	生活スタイルER	日付	NA	$	NA
17	生活スタイル入院	日付	LOS	$	NA
18	生活スタイル事務所訪問	日付	NA	$	NA
19	その他心臓病ER	日付	NA	$	NA
20	その他心臓病入院	日付	LOS	$	NA
21	その他心臓病事務所訪問	日付	NA	$	NA
22	呼吸器系ER	日付	NA	$	NA
23	呼吸器系入院	日付	LOS	$	NA
24	呼吸器系事務所訪問	日付	NA	$	NA
25	甲状腺中毒ER	日付	NA	$	NA
26	甲状腺中毒入院	日付	LOS	$	NA
27	甲状腺中毒事務所訪問	日付	NA	$	NA
28	肺塞栓症ER	日付	NA	$	NA
29	肺塞栓症入院	日付	LOS	$	NA
30	肺塞栓症事務所訪問	日付	NA	$	NA
31	貧血ER	日付	NA	$	NA
32	貧血入院	日付	LOS	$	NA
33	貧血事務所訪問	日付	NA	$	NA
34	感染症ER	日付	NA	$	NA
35	感染症入院	日付	LOS	$	NA
36	感染症事務所訪問	日付	NA	$	NA
37	その他ER	最初日	1ヶ月回数	$	NA
38	その他入院	最初日	1ヶ月累積数	$	NA
39	その他事務所訪問	最初日	1ヶ月回数	$	NA
40	その他医療事象	最初日	1ヶ月回数	$	1ヶ月CV回数
41	定期ＣＶ処置	最初日	単位計	$	NA
42	中間ＣＶ処置	最初日	単位計	$	NA
43	緊急ＣＶ処置	最初日	単位計	$	NA
44	ＣＶ外科手術	最初日	単位計	$	NA
45	ＡＣＥ抑制剤治療のＲｘ	最初日	1日分量	$	1ヶ月rx回数
46	ループ利尿治療のＲｘ	最初日	1日分量	$	1ヶ月rx回数
47	その他の利尿治療のＲｘ	最初日	1日分量	$	1ヶ月rx回数
48	ジゴキシン治療のＲｘ	最初日	1日分量	$	1ヶ月rx回数
49	ベータブロッカー治療のＲｘ	最初日	1日分量	$	1ヶ月rx回数
50	CaチャンネルブロッカーtxのＲｘ	最初日	1日分量	$	1ヶ月rx回数
51	その他ＣＶ薬のＲｘ	最初日	1日分量	$	1ヶ月rx回数
52	非ＣＶ薬のＲｘ	最初日	1日分量	$	1ヶ月rx回数
53	Na/H2O薬のＲｘ	最初日	1日分量	$	1ヶ月rx回数

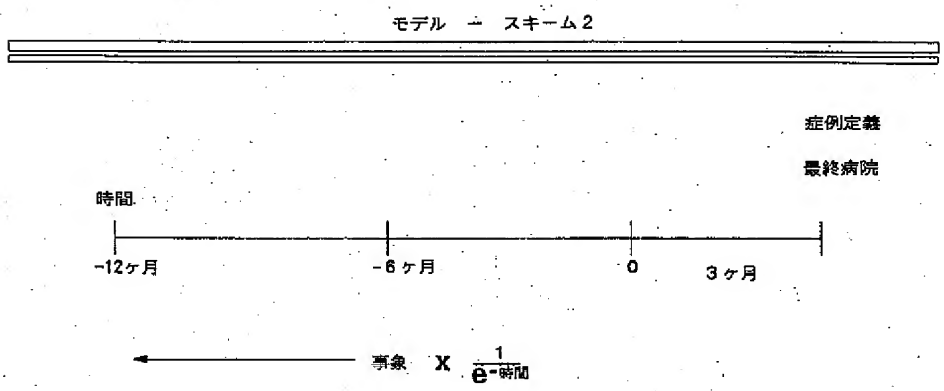
【図１１】


分析ファイル
変数 － クレームデータエレメントから生成
X_1 X_2 ・・・ X_n
会員１
会員ｘ

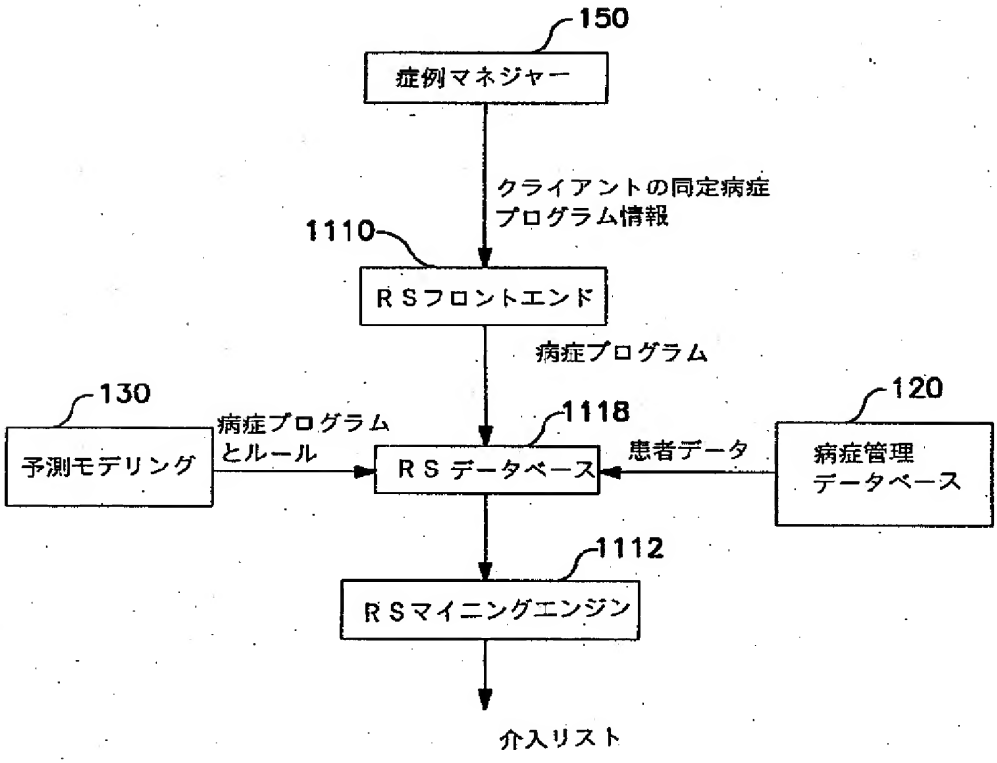
【図１３】


モデル － スキーム１
病院対病院
症例定義
時間
-12ヶ月
-６ヶ月
0
+６ヶ月
事象 X $\frac{1}{e^{-時間}}$

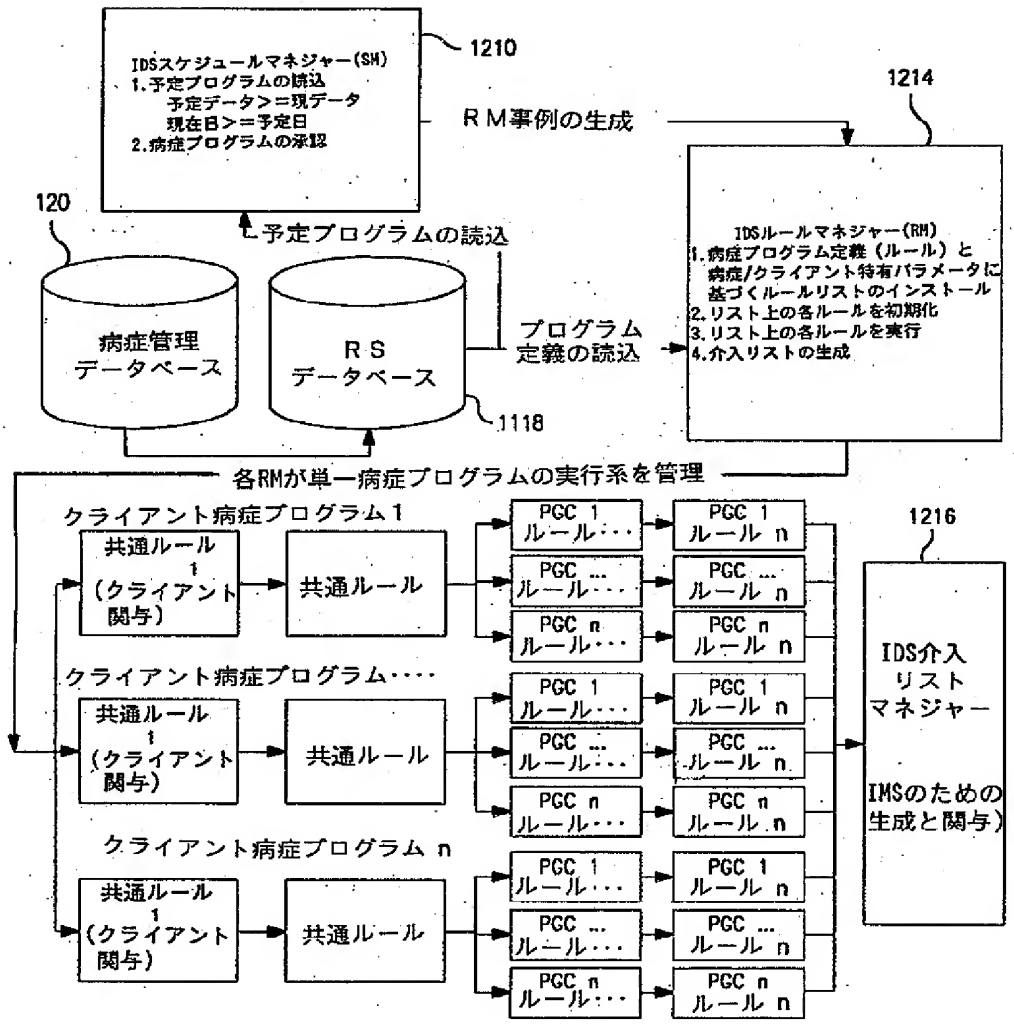
【図１４】


モデル　－　スキーム２
症例定義
最終病院
時間
-12ヶ月
-6ヶ月
0
３ヶ月
事象　X　1/e-時間

【図１５】


150
症例マネジャー
クライアントの同定病症
プログラム情報
1110
ＲＳフロントエンド
病症プログラム
130
予測モデリング
病症プログラム
とルール
1118
ＲＳ データベース
患者データ
120
病症管理
データベース
1112
ＲＳマイニングエンジン
介入リスト

【図１６】



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【外国語明細書】

DISEASE MANAGEMENT METHOD AND SYSTEM

FIELD OF THE INVENTION

This invention relates to electronic computational processing techniques in the field of human healthcare and, more particularly, to identification of high-risk patients for disease and disease intervention management using various electronic computational processing techniques.

BACKGROUND OF THE INVENTION

Diseases or condition can be more effectively and more cost-effectively treated by designing a program to maximize compliance with current best medical practices which are also consistent with a given preferred treatment regimen and on a case by case basis. Treatment for many types of diseases has moved from episodic, symptomatic treatment to disease reduction and prevention.

Healthcare costs in general are rising rapidly, and, in many cases, the costs of treating patients is not distributed evenly among the total population of patients because it costs more to treat some patients than others. This is partly due to some patients not receiving appropriate therapies for their medical condition. This problem has several causes, including that some patients do not comply with their prescribed treatment regimens, that some patients do not visit their doctors at appropriate times, and, in some cases, that some doctors are not aware that a certain therapy regimen is more likely to be more effective than their current regimen.

If patients are treated in accordance with therapy regimens proven to be effective for a given state of disease progression, then the total costs of treating the whole population will decline. If more patients are treated properly, then the number of cases which progress to more serious stages of disease, which are more costly to treat, will be reduced.

SUMMARY OF THE INVENTION

The present invention is a computer-implemented system and method for identifying at-risk patients, particularly those diagnosed with an identified disease, where the information about patients is extracted from at least one pre-existing in at least one database. The system includes a means for processing the patient information in the database based on a predetermined criteria to extract relevant information for a group of patients having or who may develop the

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identified disease. The system defines a predictive model, including associated rules, by:

a) processing, based on predetermined criteria, the patient information in the database to extract patient information for a group of patients relating to an identified disease or condition;

b) defining a predictive model, including:

i) defining, using the information available in the database, a set of events or data relevant to the identified disease or condition;

ii) converting the extracted patient information and the defined events or data into files comprising event-level information;

iii) defining a time-window for providing a timeframe from which to judge whether specific ones of the defined events should be considered in subsequent processing;

iv) identifying a set of variables as potential predictors;

v) processing the event-level information, using the time-window and the set of variables, to generate an analysis file;

vi) performing statistical analysis on the analysis file to generate the prediction model and a set of rules for use in identifying at-risk patients diagnosed with or who may develop the identified disease or condition, said prediction model and rules being a function of a subset of the set of variables;

c) applying the prediction model and the rules to the same or new set of event-level information to identify at-risk patients for the identified disease or condition, or to identify patients who may be at risk for developing the identified disease or condition;

d) preparing an intervention list from the identified at-risk patients and selecting, for at least one at risk patient, an intervention;

e) distributing or facilitating the distribution of the intervention to said patient; and optionallyf) recording and tracking an intervention result for each at-risk patient based on the respective selected intervention; and optionally

g) updating the historical data in at least one database with each intervention result corresponding to said database; and

repeating step b(ii), and

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h) re-applying the prediction model and rules to the event-level information extracted from the data in the updated database.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is best understood from the following detailed description when read in connection with the accompanying drawing, in which:

Figure 1A is a high level diagram of the Disease Management System of the present invention.

Figure 1B is a high level flowchart illustrating an exemplary overall process of the Disease Management System of the present invention.

Figure 2A is a high level flowchart illustrating the raw patient data acquisition, pre-processing, and database formation of the present invention.

Figure 2B is a high-level block diagram illustrating three exemplary sources of information suitable for use with the present invention.

Figure 3 is a flowchart of an embodiment of the conversion process of the Raw Patient Data Pre-processing process of the present invention.

Figure 4 is an illustration of an exemplary Data Model as used in the Disease Management database of an embodiment of the present invention.

Figure 5 is a diagram illustrating the research database format for each of the Rx, DR, and HL claims of the records contained in the research database of an exemplary embodiment of the present invention.

Figure 6 is a high level flowchart illustrating the Extraction process and Predictive Modeling process for an identified disease of the present invention.

Figure 7A is a diagram illustrating an event level file of one embodiment of the present invention generated for depression as the identified disease.

Figure 7B is a diagram illustrating an event level file of one embodiment of the present invention generated for congestive heart failure as the identified disease.

Figure 8 is a diagram illustrating the format of the analysis file of one embodiment of the present invention for an identified disease.

Figure 9 is a time-line diagram showing the events and prediction window scheme as used in the present invention.

Figure 10A is a time-line diagram which shows a first exemplary time window scheme suitable for use in processing the data from the event level files shown in Figure 7A and Figure 7B.

Figure 10B is a time-line diagram which shows a second exemplary time window scheme suitable for use in processing the data from the event level files shown in Figure 7A and Figure 7B.

Figure 11 is a high level flowchart showing the Risk Stratification process of the present invention including the Front End process and the Mining Engine process to generate an intervention list for an identified disease.

Figure 12 is a high level flow chart showing the Mining Engine of the Risk Stratification process of the present invention.

Figure 13 is a high level diagram of the Intervention Management process of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

General Overview

The Disease Management system and method of the invention increases the number of patients within a given population who receive, comply with, and correctly administer appropriate therapies for treating a disease or condition. The invention requires identifying preferred treatment regimens for given stages of disease progression. These regimens may be published medical guidelines or guidelines developed by healthcare professionals for a given type of disease. These guidelines are called Best Practice Guidelines.

The term "disease management" applies to, for example, managed care organization, medical group, employer, or government sponsored programs that identify individual patients with chronic long term conditions that may be at risk of expensive hospitalization or other high cost events or adverse health outcome. Disease management services are defined by a research area in conjunction with product development managers who serve as disease subject matter experts.

Disease management services are offered to clients (participating managed care organizations (MCOs) or other types of subscribers) for the purposes of early intervention at specific disease states to improve future disease outcomes. An individual's medical, clinical and administrative medical history information is provided from, for example, third party processors to the disease management system.

This specification primarily describes use of the Disease Management system of the present invention with regard to the healthcare field in which healthcare providers are the primary clients of the system, and information about

the patients of these healthcare providers are provided to a database for the practice of the invention. However, it is contemplated that other embodiments of the invention include other types of clients, such as employers, government agencies, insurance providers, or other users who are interested in disease management or the thriftiness of a given population of individuals. Similarly, the information provided to the database of the Disease Management system could be expanded to include demographic data, socialization, geographic data, family history, or other information about an individual.

A basic disease management system will look at one disease or condition. But multiple diseases or conditions can be factored into a single analysis and thereby develop a risk profile based on multiple factors and multiple diseases or conditions. In essence, the approach is to view each disease or condition as a module which can be cross-referenced like the fields of a relational data base. That permits the analyst to draw on more than one disease or condition in developing a risk factor for a given patient population.

Referring to Figure 1A, the high level diagram of the disease management process of the present invention includes a Patient Medical Information source 100, a Predictive Health Outcome Modeling process 102, a process for Intervention of At-risk Patients 103, a source of disease management Modeling Guidelines 104, and a source of Intervention and Medical Guidelines 105. The process for Intervention of At-Risk Patients 103 has two parts: a Risk Stratification process 140 and an Intervention Management process 160. The Patient Medical Information source 101 is typically a form of database containing, for example, records of medical history, physical descriptions, psychiatric records, laboratory tests results, cognition and intelligence test data, prescriptions and treatment of patients who participate in a healthcare provider's program.

The Predictive Health Outcome Modeling process 102 of Figure 1A is a process that produces a statistical model which can be used to predict whether a patient with a particular disease or condition and medical history is likely to suffer an adverse health outcome. The process of Intervention of At-risk Patients 103 includes: the Risk Stratification process 140 that is a database analysis process which derives a list of at-risk patients who have a high risk of suffering an adverse health outcome, and the Intervention Management process 160 that

determines an intervention in the selected patient's healthcare treatment to decrease the possibility of such an adverse health outcome.

The operation of the disease management process of the present invention, as shown in Figure 1A, is now described. First, the Predictive Health Outcome Modeling process 102 receives a sample group of patient data from the Patient Medical Information database 100 for a given disease. In addition, the Predictive Health Outcome Modeling process 102 receives certain pre-determined statistical or other information for generating predictive models, shown as the Modeling Guidelines 104 in Figure 1A, and generates a particular predictive model for a particular disease to determine the probability of an adverse health outcome. The same or similar data could be used to determine the probability of developing a particular disease or condition which is associated with an adverse health outcome.

The Risk Stratification process 140 receives the predictive model provided by the Predictive Health Outcome Modeling process 102 and analyzes the individual patient-specific data from the Patient Medical Information database 100 with the predictive model to identify a list of current patients that are at-risk of an adverse health outcome for a particular disease. Once the list of patients is identified, the Intervention Management process 160 suggests an intervention in the treatment process of the patient through contact with the patient, physician, or healthcare provider. The process of Intervention of At-risk Patients 103 requires externally generated information about treatment regimens (e.g. Best Practice Guidelines) for given stages of disease progression, as well as particular interventions, which are shown as the Intervention and Medical Guidelines 105 of Figure 1A.

Finally, the interventions itself may be recorded, and once the process of Intervention of At-risk Patients 103 has been completed, the results of these interventions, shown as intervention outcome measurements in Figure 1A, are recorded in the Patient Medical Information database 100. This allows for a feed-back step where data after intervention can be fed back through the whole process, either to be again re-run through the Risk Stratification step to help analyze the outcomes or to become part of the basis for generating a new and revised Risk Stratification process.

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To summarize, the disease management system analyzes the flow of individual, patient-specific health information and intervenes with the physician or patient whenever necessary to attempt to avoid adverse health outcomes and consequent high cost events. Disease management includes:

1) Identifying the client organization and prospective program patient enrollees based at certain predetermined disease states derived from research data.

2) Utilizing medical claim, pharmacy claim, clinical data and laboratory data to assess disease states.

3) Utilizing pre-defined interventions to manage the program. Examples of interventions could be mailing periodic notifications, mailing disease educational material, patient-initiated phone survey responses or even outbound calling performed by a staff of health care professionals.

4) Administering the process with case program managers who perform the necessary intervention with the client (e.g. MCO, healthcare provider), doctor and patient.

5) Recording interventions in patient care to determine if proactive disease management services improve specific disease outcomes.

6) Processing intervention management information back through an analytic process to determine the outcome of intervention.

In the method of this invention, the case program manager (not shown in Figure 1A, but whose functions are shown as part of the Case Management process 150 of Figure 1B, which is described in detail below) facilitates patient treatment by identifying to physicians patients who are likely to benefit from a change in therapy; and by suggesting therapies to the physicians; and by providing educational and treatment compliance assistance to patients (with the concurrence of the treating physicians). The case program manager does not diagnose disease or prescribe treatment regimens. Medical diagnosis and treatment is the sole responsibility of licensed physicians.

By employing the process of the present invention, the case program manager identifies patients receiving therapy and, more importantly, the subset of these who are not being treated in accordance with the preferred treatment regimen for the patient's disease state. This population of patients is very relevant to this invention; from this population, the treatment regimen of those

patients who are not receiving the preferred therapy regimen can be automatically identified and influenced to change habits or conform to the recommended treatment regimen.

For convenience, in the subsequent description of the present invention, the case program manager is shown as a single source of external information such as that from the Modeling Guidelines 104 for the Predictive Health Outcome Modeling process 102, and for the Intervention and Medical Guidelines 105 for the process of Intervention of At-risk Patients 103.

Generally, most functions of the case program manager are automated and implemented by, for example, a dedicated computer system. However, end users may: provide external information as a disease management program is initiated, provide changed or new parameters to a disease management program based on experience, or modify intervention techniques as needed.

For most embodiments of this invention, the roles of the case program manager are divided among multiple persons or entities. For example, one "case management" entity can identify patients at risk for becoming "high-cost" patients, another entity can contact physicians with this information and with treatment advice as well as with patient educational materials and treatment compliance devices, and yet a third entity can contact physicians directly. Still another entity can be responsible for managing the identification of statistical information and creation of predictive models. As a result of carrying out the method of the invention, a larger number of patients receive appropriate therapies than would otherwise, and, consequently, a smaller number of patients suffer from serious disease progression requiring extraordinary, and expensive, care.

The method of the invention typically involves at least several treating physicians. One preferred embodiment includes approximately 100 treating physicians, but is also effective with larger numbers of physicians, e.g., 250 to 500 physicians, or more.

The Disease Management System

A high level flowchart of the Disease Management System of the present invention is shown in Figure 1B. Referring to Figure 1B, the Disease Management system includes a Disease Management Data Repository system 101 which includes the Patient Data Collection and Integration process 110 and the Disease Management Database 120. This is where the event-level

information resides. Next, the Disease Management system includes a Predictive Modeling process 130, a Risk Stratification process 140, an Intervention Management process 160, and an Intervention Records and Tracking process 170.

A Case Management process 150 receives Intervention information from the Intervention Management process 160 and Results from the Intervention Recording and Tracking process 170. The Case Manager 150 provides externally derived information to the Predictive Modeling process 130 and Risk Stratification process 140.

The Disease Management Data Repository system 101 includes a Patient Data Collection and Integration process 110 and a Disease Management Database 120. The Patient Data Collection and Integration process 110 receives raw patient data from healthcare sources, and processes the raw patient data to remove redundant information and format the raw patient data into a common, predetermined format. Initially, one or more sources of information are required which allow for identification of an initial population of patients.

Typical sources of raw patient data may include, for example, healthcare providers such as doctors, hospitals, pharmacies, other healthcare providers, and payers who pay for these services which all keep records for their patients. These records, however, may be scattered, difficult to access, have different formats, and contain duplicate or incorrect information. Therefore, a more accessible source for such information exists in the health care claims records of a given benefits provider. These health care claims records are used in one exemplary embodiment of the invention.

The Patient Data Collection and Integration process 110 stores the formatted patient information in the Disease Management Database 120, which is the database storing the patient medical records, clinical data or other data used by the present invention.

The Predictive Modeling process 130 of the present invention uses an identified disease, statistical restrictions, and a sample patient database to create a predictive model and rules which can identify patients, from a predetermined identified disease patient population, who are at high risk to adverse health outcomes. As used herein, the term "identified disease" refers to a particular

disease about which the client may be concerned, such as asthma, depression or congestive heart failure (CHF).

The Risk Stratification process 140 of Figure 1B applies a statistical predictive model and rules to patient data from the Disease Management database 120 corresponding to a group of patients selected from the Disease Management database 120 based on a predetermined criteria. The predetermined criteria could be "all client (MCO) patients" or "all new employees" for example. The Risk Stratification process 140 identifies a subgroup of at-risk patients and creates an intervention list from the subgroup.

The Intervention Management process 160 schedules and performs interventions for each identified patient on the intervention list, such as sending letters or educational materials, and making phone calls or home visits, to these at-risk patients. Finally, the Intervention Records and Tracking process 170 keeps a record of the interventions performed and their effects.

The operation of the Disease Management System as illustrated in Figure 1B is now described.

First, a particular disease of concern, as well as other predetermined restrictions, are identified by the Case Management process 150. The identified disease and restrictions are supplied to the Predictive Modeling process 130. The Predictive Modeling process 130 receives a subgroup of patient medical data from the Disease Management Database 120 corresponding to patients having the identified disease and meeting other predetermined statistical criteria determined from research data. The Predictive Modeling process 130 then creates a predictive model and rules from the subgroup of patient medical data which can identify patients from a predetermined identified disease patient population who are at-risk to adverse health outcomes.

The Risk Stratification process 140 receives the output predictive model and rules from the Predictive Modeling process 130, and further rules from the Case Management process 150. Based on the information provided by the Case Management process 150, medical and clinical information for a group of patients contained in the Disease Management database 120 is retrieved, and the group of patients is the predetermined client's identified disease patient population. The Risk Stratification process 140 then uses the predictive model and rules to identify a high-risk subgroup of patients from the predetermined

client's identified disease patient population who are at-risk of adverse health outcomes.

Identifying a high-risk subgroup is a subjective undertaking which is defined by the operator. It is not a procrustean bed. For example, "high-risk" can be determined based on the severity of the disease or condition. Or it can be driven by available resources; there may be only so many resources available versus the cost of providing useful interventions. A classic example of "high-risk" is the triage approach used in dealing with major catastrophes: don't treat those who will die anyway, don't treat those who will live anyway; treat those for whom available intervention may result in survival or a lessening of permanent disability. Another example is to define the high-risk subgroup as comprising a certain percentage of the total group based on how many patients a particular operation can handle. So if the through-put of a particular system can only handle or manage interventions in 1000 patients on a given day, then the 1000 patients most in need out of the total population will be defined as the "high-risk" subgroup. In a similar way, the intervenor may have only enough money to usefully intervene in 1000 patients in six months. Hence by definition the 1000 patients most at risk become the "high-risk" subgroup. Another example is one where clinical outcomes are ranked from 1 to 5 in terms of possible useful outcome, and it is decided that those with a possibility of a good outcome ranking of 3 or greater should be progressed as the "high-risk" subgroup. In addition, age and age-related likelihood of an adverse outcome, or a positive outcome, may be used in defining a "high-risk" subgroup. For example it may be decided to define high-risk as those who are female, past menopause, and have a family history of an estrogen-dependent disease. And 2 or more of these factors will usually be combined in creating the algorithm for identifying the "high-risk" subgroup. These are but a few examples of how one might define "high-risk".

It should be noted also that although this step is described in terms of identifying a single "high-risk" subgroup, graded levels of intervention can also be defined and factored back into this analysis. So rather than defining a high-risk subgroup, one could define a set of subgroups where each was accorded a particular risk factor, and then intervention carried out on a selected set of subgroups based on different levels of accessed risk.

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Once the high-risk subgroup, or a set of target subgroups, has been identified, the Risk Stratification process 140 creates an intervention list ranking the patients according to a predetermined criteria. The intervention list is used by the Intervention Management process 160 of the present invention to schedule and perform interventions, such as sending letters or educational materials, and making phone calls or home visits, to these high risk patients to prevent and/or improve their likely health outcomes.

The Intervention Management process 160 takes a data feed from the Disease Management Database 120, and the data is "client" identified disease patient data which is normalized into the Disease Management Data Repository format. This data feed or detection process has parameters and rules received from the Case Management process 150 that identify a specific patient meeting the conditions for participating in a disease program. This detection process provides a population for consideration in the specific identified disease program.

The Intervention Management process 160 also passes intervention contact data back to the main Disease Management Database 120 and the intervention list to the Case Management process 150. This intervention contact data is used in the analytic process to, for example, determine the success of the particular form of intervention.

The Intervention Record and Tracking system 170 keeps a record of the interventions and their effects, from which the Case Management process 150 can update external information used by the Predictive Modeling process 130, as well as guidelines for interventions, and the Best Practice Guidelines to improve treatment regimens for an identified disease.

The following sections describe in detail each of the processes of the Disease Management system of the present invention, as illustrated by Figure 1B.

The Disease Management Data Repository and Data Integration

The Disease Management Data Repository 101 is described with reference to Figure 2A, which is a high level flowchart illustrating the raw patient data acquisition, pre-processing, and database formation of the present invention. The Disease Management Data Repository 101 includes the Patient Data Collection and Integration process 110, Disease Management Database 120, and a Research Database 250.

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The Patient Data Collection and Integration process 110 includes Reimbursement Claims sources 200 as a data source, a raw Patient Data Pre-processing process 210 to "clean-up" the raw patient data, a Conversion process 220 for converting the raw data to a predetermined format, and an Update Patient Data process 230 to update patient information due to subsequent events or interventions (also called event-level information).

In the Patient Data Collection and Integration process 110, Reimbursement Claims sources 200 provide raw patient data to the raw patient data pre-processing algorithm. The exemplary sources of information, which allow for the identification of a population of patients who are currently provided medical treatment, are the clinical records and the health care claims records of many healthcare benefit providers. As is known, claims for drug reimbursement, doctor visits, hospital stays, and laboratory tests are received and processed for payment/reimbursement. In the exemplary embodiment of the present invention, this claims information is entered into, for example, a DB2 or Sybase database on a computer system (not shown).

The present invention is not limited, however, to these Reimbursement Claims sources 200 as shown. In another embodiment of the invention, data concerning individuals, such as demographic data; social data; personal data such as lifestyle, a history of sexual abuse or parental neglect or physical abuse, nutritional status; geographic data; family history; or other data can be used to populate the Disease Management Database.

The method of the invention is typically carried out with the assistance of an electronic database for storage, and retrieval, of data concerning an individual, such as medical data, demographic data, pharmaceutical data, diagnosis data and treatment data, from reimbursement claims sources 200. For example, the following pharmaceutical data can be retrieved from reimbursement claims:

a) patient identifier
b) drug prescribed
c) drug dosage
d) amount of drug
e) duration of drug therapy
f) dates of recent prescription fills/refills

g) provider identifier.

The data are stored preferably in machine-readable form and are recoverable in discreet, searchable fields with a discreet record for each patient. Each record also preferably comprises a field for noting whether or not one or more case management interventions as described herein have been undertaken. The data are stored in a computer and accessed through customized database utilization software. Such software provides searching and reporting (display, printing, and electronic distribution) capability.

Figure 2B is a high-level block diagram illustrating three exemplary sources of information suitable for use with the present invention. As is illustrated in Figure 2B, the claims information of such a provider would typically include three sources: pharmacy (Rx) claims 202, doctor (DR) claims 204 and hospital (HL) claims 206. As listed on the blocks representing the claims information, many types of information would be available from the respective claims including drug codes, physician's names, diagnosis codes, procedures, various dates and other relevant information. Much of this information is referenced using codes, such as drug codes, procedure codes and illness codes.

Continuing with Figure 2A, the Raw Patient Data Pre-processor 210 performs data integrity checks which identify and process rejected or reconciled claims.

To make the use of the database more efficient, the database utilization subalgorithm (not shown) of the Raw Patient Data Pre-processing algorithm 210 has the capability of eliminating redundant entries, of eliminating entries for patients who have become ineligible and of ignoring records for which a case management intervention has been undertaken within a preset period of time.

Second, the Conversion algorithm 220 reads the source data files and populates the Disease Management Database 240 with the patient information in a predetermined database format. The Disease Management Database 240 of the present invention uses Sybase, but any similar database product may be used.

Finally, the Update Patient Data process 230 of Figure 2A receives intervention management information from the Intervention Management process 160 and Intervention Recording and Tracking process 170 and updates the

patient information of the Disease Management Database 120 to include information about interventions regarding the member patient.

A more detailed flowchart of an exemplary embodiment of the Conversion process 220 is shown in Figure 3.

Referring to Figure 3, the File Manager 310 receives patient data files and identifies the incoming files, verifies that they are suitable for processing, and stores information about each file in a file inventory database. If the file is Hierarchical, the File Manager 310 sends the file to the Hierarchical File pre-processor to read the contents into flat files. The flat files are then stored into the Disease Management Database 240 by the Flat file Processor 330 using the information contained in the Input configuration table 340 and Output configuration table 350. The patient data is then stored in the database using a Data Model.

Figure 4 is an illustration of an exemplary Data Model as used in the patient data repository of an embodiment of the present invention. The Data Model includes a Source Data Inventory 410, which records aspects of incoming data during database population; an Exception Handling process 420 which handles data exceptions during the population process; Client Tables 430, which contain lists of the Disease Management provider clients; and a Member Table 440, which includes member specific identity information.

The Data Model also includes, for each member patient in Member Table 440, a Claim Table 450, which is a record of healthcare activity for a single member; a Laboratory Table 460, which represents the entities and relationships involved in gathering clinical test data for a given member; and a Diagnosis and Procedure Table 470, which contains a record of related diagnoses and medical procedures for a given claim.

The organization process of the Data Model is as follows. Referring to Figure 4, the source Data Inventory 410 records the progress and nature of incoming data during the database population process. The Exception Handling 420 handles data exceptions during the population process. The exception may be caused by missing values, values out of range, or other errors in the data, and the Exception Handling 420 resolves these exceptions when they occur by throwing away the data, retaining some of the data, or resolving the errors based

on available information. The Source Data Inventory 410 provides received client data to populate the database with Client Tables 430.

The Client Tables 430 contain lists of the Disease Management provider clients which have patients and are subscribing to the system and method described in the invention. Each client in the Client Table 430 has patients defined as members in the Member Table 440. The Member Table 440 includes such information as member name, date of birth, and gender.

For each member patient in Member Table 440, a Claim Table 450 is kept. Each claim in Claim Table 450 is a record of healthcare activity for a single member. Data items recorded are, for example, dates when the claim was initiated or resolved, drug and prescription information, details of a medical examination, the member's primary or other physicians, and encounter services or procedures provided.

In addition, the Laboratory Table 460 represents the entities and relationships involved in the requisition, accession, and resolution of laboratory tests performed for a given member. Data items recorded are, for example, blood tests, glucose tests, or other tests based on a single analyte.

Finally, the Diagnosis and Procedure Table 470 records primary and one or more secondary diagnoses for a given claim, which are expressed as ICD-9-CM codes. Diagnoses can be grouped together into a Diagnosis-Related Group (DRG), and a DRG is one of 495 classifications of diagnoses in which patients demonstrate similar resource consumption and length of stay patterns. The Diagnosis and Procedure Table 470 also records procedures corresponding to each diagnosis, and these procedures can be expressed as out-patient CPT codes, in-hospital HCPCS, or other proprietary codes.

A second, identified disease specific database is created for the purposes of providing a database of identified disease patient data for the Predictive Modeling process 130. Returning to Figure 2A, this database is the Research Database 250 which is a claims level database in a predetermined format, such as SAS format. Although Figure 2A shows that the identified disease sample patient data used to populate the Research Database 250 is provided by the Disease Management Database 120, the present invention is not so restricted and the Research Database 250 can be populated from Reimbursement Claims sources 200 using an appropriate pre-processing algorithm.

Exemplary formats illustrating the research database format for each of the Rx, DR, and HL claims of the records contained in the research database are shown in Figure 5. As shown in Figure 5, claims are listed from claims 1 to claim x and the appropriate information, for the particular service provider being claimed, is also presented. The DB2 database still represents a source of raw data elements which require processing by the raw patient data pre-processing algorithm 210. Subsequently, the data is routinely downloaded into a Research Database 250.

Creation of Predictive Models

Turning to the statistical prediction modeling, Figure 6 is a high level flowchart illustrating the sample patient data extraction process and predictive modeling process for an identified disease according to the present invention. As shown in Figure 6, the Predictive Modeling process 130 includes the steps of 1) Extracting Identified Disease Sample Data 610; 2) Performing a Quality control operation (optional) 620; 3) Checking Whether the Data is Statistically Valid 630; 4) Converting Claims level data into Event Level Data 640; 5) Processing the Event Level Files into Analysis Files 650; and 6) Processing the Analysis File using Statistical Techniques to create an identified disease prediction model and rules.

Referring to Figure 6, the process of determining a predictive model begins with step 610, Extracting Identified Disease Sample Data. The extraction process of step 610 receives the sample patient data from the Research Database 250 and an identified disease from the Case Management process 150 when the data has been converted to SAS format, SAS procedures process the information to: 1) extract patients with the identified disease (step 610), 2) process the claims level information into event level information (step 640), 3) using predetermined variables and timeframe schemes, generate analysis files for analysis purposes (step 650) and 4) create a prediction model as a function of those variables most reflective of the correlation to an adverse health outcome (step 660).

It should be mentioned that, from a statistical perspective, an important consideration in developing prediction models from datasets is sample size. To maximize the integrity of the prediction model, a valid sample size is an important factor, and sample sizes required to determine prediction equations

depend on the magnitude of association between variables. As these associations are unknown, all patients within any individual plan are initially included.

The first step, extracting patients with an identified disease or condition (step 610), uses various parameters provided either by the case program manager, research source, or other healthcare professional to define which patients qualify for the overall initial universe of patients with the identified disease to be considered.

For example, in one exemplary embodiment of the present invention, only patients having a continuous enrollment with the benefits provider of 12 months or longer and having a claim for depression or treatment with anti-depressant medication are eligible. Of course, these criteria are exemplary and could be modified such that 24 months or 6 months of enrollment is satisfactory or that an individual must be 18 years of age. In the exemplary embodiment of the present invention, the Extracting of Identified Disease Sample Data, step 610, extracts all claims data for patients with either an appropriate code for an identified disease (such as depression; see Appendix I) or for treatment with a drug used in treatment of the identified disease (for example, for depression, an antidepressant drug; see Appendix III).

It should be noted that in the health care industry various codes are used in claims information for indicating which procedures, treatments, diagnoses, drugs, etc. are being claimed. For the exemplary embodiments of the present invention, examples of the selected codes are shown in Appendices I and II. These codes were found in Physician's Current Procedural Terminology (CPT), American Medical Association (1995) and St. Anthony's ICD-9-CM Code Book (1994) which are both hereby incorporated by reference for their teaching of codes and sources of codes. As will be appreciated by those skilled in the art, any set of codes, representative of the various procedures, treatments, diagnosis, drugs, etc. relevant for use with the present invention would suffice. References to such codes occur throughout this specification.

Subsequent to the extraction process of step 610 of Figure 6, the claim adjustment and integrity checks are optionally performed in the data Quality Control step 620. The Quality Control step 620 is optional, as, for example, the patient data for an identified disease may not require the step or the original

Disease Management Database 120 may already be of sufficient quality due to the raw Patient Data Pre-processing step 210 (shown in Figure 2).

One method of Quality Control of step 620 generates, from the dataset defined above, intermediate output files which contain sets of frequency counts for processing purposes. In one exemplary embodiment of the present invention, with depression as the identified disease. intermediate output files for the following characteristics are generated for review:

a. frequency counts of unique members by sex, age groups (0-9, 10-19...) and enrollment duration by months including:

i) Tables showing count of members by sex, ii) Table showing count of members within age groups, iii) Table of counts of age groups broken down by sex, iv) Table of enrollment duration by months i.e., 1 month to maximum number of months possible.

b. frequency counts of ICD codes for depression (Appendix I), i.e., number of members having at least one hit with each of the ICD codes in Appendix I-a any level ii) as first code.

c. frequency counts of anti-depressant drugs (Appendix II):

i) number of members who have at least one claim for each of the drugs in Appendix III.

d. count of members who became eligible for processing due to ICD code only, by drug only, and by both ICD code and drug.

e. frequency counts of numbers of all claims within each file (HL, DR, Rx) by member.

f. frequency counts of ICD codes (use only the first 3 digits of ICD codes) of any nature in DR (any position) and HL files - at least the top 10 with frequency of each. i.e., 2 tables one each for DR and HL files.

g. frequency counts of hospitalizations by calendar month. Counting calendar month backward from last month of eligibility or data availability. The last month for which data is available will be month 1, the penultimate month with be month 2 etc.

h. frequency counts of procedures related to depression (CPT codes, Appendix I-b).

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i. frequency counts of all CPT codes (to the level of the first 3 code digits) - at least the top 10.

The above frequency counts for use in performing preliminary evaluations as to the integrity of the data are exemplary and could be modified to include/exclude parameters which are shown to be more/less useful.

In another exemplary embodiment of the invention, with Congestive Heart Failure as the identified disease, the following frequency counts are generated:

A) First, a frequency count of the number of enrollment periods for the members is generated. Then, for members with multiple enrollment periods of at least 6 months duration, it is determined if a CHF diagnosis is present in each enrollment period. Consequently, enrollment periods without a CHF diagnosis are excluded and, for members with multiple enrollment periods that have a CHF diagnosis, only the most recent enrollment period that contains a CHF diagnosis is kept.

B) For the one enrollment period for all remaining members, all costs, denoted ALL COSTS, encountered by that member during the entire enrollment are identified. A complete proc univariate for ALL COSTS is provided for each plan separately and all plans together. It should be noted that "proc univariate" is a SAS procedure which generates descriptive statistics (e.g., mean, standard deviation, etc.)

C) From the ALL COSTS determined above, costs which are specifically cardiovascular (CV), denoted CV COSTS, are identified. In doing so, a cost is considered to be a CV COST if a claim from the DR or HL file has any CV ICD-9 code in the first or second position. If a claim from the Rx file is from therapeutic class 04000 then it is counted as a CV claim and count cost as a CV cost. A complete proc univariate for CV COSTS is also provided for each plan separately and all plans together.

D) From the CV COSTS, those costs which are specifically congestive heart failure related, denoted CHF COSTS are identified. A cost is considered to be CHF COST if a claim from the DR or HL file has any CHF ICD-9 code in the first or second position. A complete proc univariate for CHF COST is also provided for each plan separately and all plans together.

E) For all member enrollment periods remaining, the total member months for each plan is calculated separately and together. In doing so, a

member is considered enrolled during any month that they were enrolled for at least one day. For this, a complete proc univariate is provided for member months for each plan separately and all plans together.

F) Finally, a unique member count is provided for all patient status code = 20 within the remaining enrollment periods. It is noted that status code = 20 indicates that the patient has expired or did not recover.

It should be noted that, regarding the cost calculations, the following guidelines apply in the exemplary embodiment of the present invention:

a. the cost of inpatient hospitalizations, emergency services, physician/outpatient, and other medical services on a per claim basis are considered to be:

AMTPAID + AMTCOPAY + AMTRESERVE + AMTDEDUCT

b. the cost of drugs are considered to be:

AMTPAID + AMTCOPAY

where AMTPAID is the amount paid, AMTCOPAY is the amount co-payed, AMTRESERVE is the amount reserved and the AMTDEDUCT is the deductable amount.

It should also be noted that, for purposes of a cost hierarchy, the following rules were used in the exemplary embodiment of the present invention.

1. Only hospitalizations for CHF can spawn other events.

2. Hospital costs include all Rx, procedure, physician charges.

3. Hospital visits can generate Rx and procedure events with costs set to zero (included in hospital cost).

4. Hospital visits cannot generate separate doctor visit events.

Once again, the above information, which is used to perform preliminary evaluations as to the integrity of the data, is exemplary and could be modified to include/exclude parameters which are shown to be more/less useful within the spirit of the present invention.

With this information, a "quality check" is performed on the initial universe of identified disease patients to make sure that the final results, i.e., prediction model, is not unreasonably skewed due to invalid input information. This processing for maintaining data quality, Quality Control step 620, produces intermediate output files, and allows for a refinement of the extracted information by, for example, checking to see if an imbalance exists in the

extracted information such as all claims are from individuals over 60 years of age, all claims are from men, or other data imbalances which would otherwise taint the integrity of a prediction model. Step 620, in the exemplary embodiments, is performed manually by viewing the intermediate output files. It is contemplated, however, that using various threshold values, the frequency counts can be automatically scanned for a potential imbalance.

Having now extracted and refined the claims level information according to various predetermined criteria deemed relevant for subsequent processing purposes, the information is converted into an event level format.

Returning to Figure 6, the next step is the Convert Claims Level Data to Event Level step 640. To provide processing flexibility, particularly in assigning time windows for analysis, the above-mentioned second step (i.e., converting the claims level information into event level information, step 640) is employed to generate two primary data files from which an analysis file can be created.

In the exemplary embodiment of the present invention, primary data file 1 is a member level file and contains all data of a static nature (i.e., not time sensitive) such as 1) Member Key, 2) Date of birth, 3) Gender, 4) First available date of enrollment (i.e., start of dataset (1/1/92) or enrollment date), 5) End date of enrollment (i.e., end of dataset or last date of enrollment), 6) Date of first identified disease event (for example, first prescription for antidepressant, or hospitalization for congestive heart failure), 7) Date of last hospitalization, 8) Number of records in events file (primary file 2), and 9) Mode of entry into the dataset (e.g., i) Anti-depressant drug only, ii) Depression diagnosis only, iii) Both anti-depressant drug and depression diagnosis).

Primary data file 2 is an event level file with a record for each event ordered by member and the chronological date of the event, and, in the present invention, presented in descending order of event date.

It should be noted that an event, sometimes referred to as an episode, is an occurrence which, based on clinical knowledge, is deemed relevant to the identified disease. Having knowledge of what raw data elements are available from the claims, a set of events is defined directly or indirectly from the data elements where events can be based on an individual data element, a combination of data elements or it can be derived from individual or multiple data elements.

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Figure 7A is an exemplary list of events and format for primary file 2 (an event level file) for depression as the identified disease. As shown in Figure 7A, the entries provided include:

1. Hospitalization for depression
    a. Any hospital claim identified by hospital site code.
    b. Having a from and through duration of at least 1 day.
    c. Having ICD 9 code.
    d. Depression ICD 9 code occurring at any position.
    e. Illness indicator (Appendix V) 1 = major illness, 2 = suicide, 3 = major illness and suicide. 0 = everything else.
2. Emergency room for depression
    a. Emergency room visit identified by emergency room site code.
    b. Having ICD 9 code (see Appendix I-a).
3. Doctor (non-hospital) visit for depression
    a. Any doctor claim.
    b. Having ICD 9 code (see Appendix I-a).
    c. Category : Psychiatrist =- 1, all others = 0.
4. Prescription for SSRI
    a. SSRI (selective serotonin re-uptake inhibitors) therapeutic class 5.51.3.
    b. Cost = 0 if generated from a hospital admission.
    c. Category indicator = blank
5. Prescription for (Tricyclic antidepressants) TCA or (Monoamine Oxidase inhibitors) MAOI
    a. Therapeutic classes 5.5.1.1 (tertiary amines), 5.5.1.2 (secondary amines), 5.5.1.4 (Monoamine Oxidase inhibitors). AND 5.5.2
    b. Cost = 0 if generated by a hospital admission
    c. Category indicator = therapeutic class 1 = 5.5.1.1, 2 = 5.5.1.2, 3 = 5.5.1.4, 4 = 5.5.2
6. Prescription for other neuroactive drug (From Rx file)
7. Procedure for depression (from DR or HL files)

Category:	CPT codes or ICD procedure
0 = Psychotherapy	All CPT and ICD codes in

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		Appendix I-b not listed below.
1 = Diagnostic	90801, 90820, 90825, 90830, 90862	
		94.0x, 94.1x, 94.2l, 99.22, 94.23
2 = Shock therapy	890870, 908712	
		94.24, 94.26, 94.27

For this entry, costs are assigned to the doctor visit or hospitalization in which the procedure occurred.

8. Hospitalization not for depression

It should be noted that items under entry 8 could have been performed for a condition other than depression although these patients got into the cohort by virtue of receiving a depression diagnosis or receiving and antidepressant at some time making it likely these procedures were for depression.

a. All hospitalization having from and through dates of at least one day duration.

b. Major illness ICD 9 codes (see Appendix V).

c. Category as in 1 above (1 = major, 2 = suicide, 3 = both, 0 = all others)

Counts for entries 9-13 are aggregated for each month. The date is that for the first occurrence of the identified events. In the number field, the number of identified events occurring in that month are summed.

9. Emergency room not for depression

a. Emergency room visit identified by Emergency room

10. Doctor (outpatient) visit not for depression

a. Any doctor visit.

b. Excluding visit with a depression diagnosis (Appendix I-a) i.e., not in 3/above.

11. Prescription for possibly related drugs

Drugs identified in Appendix IV

12. Prescription for all other (non-depression) drugs

All drugs not included in Appendices III or IV.

13. Procedure not for depression (from Dr and HL files)

a. Category indicator 1 = major procedures, 2 = minor procedure (see Appendix IV).

Figure 7B illustrates the exemplary list of events and format for primary file 2 (an event level file) for the exemplary embodiment with congestive heart failure as the identified disease. This embodiment exemplifies that the primary files 1 and 2 can be subdivided using the following exemplary ground rules which provide counts for the various events:

I. Count as a hospitalization event, denoted HOSPITALIZATION, (using both 1st and 2nd ICD-9 codes) a claim having a from and through date of at least one day and having a site code of 04. It is noted that a site code distinguishes between the sites at which the service under consideration took place (e.g., emergency room, doctor's office, etc.). It should be noted that costs go to 1st ICD-9 code category only. Also, if a new hospitalization occurs within one day of discharge from a previous hospitalization, the two hospitalizations are bridged into one. If a new hospitalization occurs greater than one day following a previous hospitalization, the second hospitalization is considered a new one.

II. Count as an emergency room visit event, denoted ER VISIT, (using both 1st and 2nd ICD-9 codes) a claim having a site code of 07, 08 or 10 OR a claim with the following the Hospital Common Procedure Coding System (HCPCS) codes: A0010-A0070, A0215-A0225, A0999 with a provider code = 81. It should be noted that costs go to 1st ICD-9 code category only.

III. Count as an office visit event, denoted OFFICE VISIT, (using only one ICD-9 code) a claim having a site code of 01 or 06 and having a unique date of service (DOS) but allow for different provider keys on the same DOS (if same provider key on same DOS, consider to be the same office visit) BUT if an office visit event occurs during a hospitalization, do not generate an office visit event (Attribute all costs for this event to the hospitalization). ALSO count as an OFFICE VISIT a claim with the following HCPCS codes: A0080-A0210 with provider code = 81. For all other office visit events, costs go to 1st ICD-9 code category only. It should be noted that the following provider keys are not considered as separate office visits and should be bridged with an office visit that occurs on the same DOS if one exists: 1) 24 (therapeutic radiology), 2) 34, 35 (independent lab), 3) 55 (hosp o/pat lab x-ray).

The three event types illustrated above are then further defined according to the associated Diagnoses.

The next step of Figure 6 is the Processing of Event Level Files into Analysis Files, step 650. After generating the two primary files using the above described instructions corresponding to step 640, further processing using timeframe information and selected variables (independent and dependent variables) is performed on the event level data to generate an analysis file, at step 650.

Figure 8 shows an exemplary format for the analysis file. As shown, the format of the analysis file includes a list of members in a first column of a table. Across the top of the table is a list of variables, described in detail below. The body of the table provides indications as to a member's relation to a listed variable.

In particular, the processing from the primary files to the analysis files in step 660 includes an algorithm defined, in part, by a time window and a plurality of variables. The algorithm can be re-programmed for various time window adjustments as well as variable modifications. The analysis file generated at this step is a member level file (i.e., organized with respect to members). The main analysis files are member level files derived from the information in the primary files.

Each main analysis file is created to take into account a single reference time window of censored events and prediction window of interest for that file. Each new time window applied to the data, in the exemplary embodiment, requires another main analysis file.

To generate the analysis file, a time window scheme, along with a plurality of variables, is applied to the event level data.

Discussing the variables first, included in the processing are both independent and dependent variables. The independent variables basically represent potential predictors of the adverse health outcomes; whereas, the dependent variables basically represent the adverse health outcome to be predicted.

To determine exemplary independent variables for step 650, as many of the original data elements as possible are used, assuming nothing about the identified disease. Then, based on clinical knowledge about the identified

disease, additional variables are created. Furthermore, combinations of the data elements and/or variables, based on clinical knowledge, are used as variables. Finally, some variables may be created and used based on their potential utility as a leverage point in disease management.

In the exemplary embodiment of the present invention, the plurality of variables, in addition to each of the items in the event file, currently used by step 650 in the SAS routine for generating an analysis file for the exemplary embodiment with Congestive Heart Failure (CHF) as the identified disease are shown below in Table 1. It is noted that each of the events in Figure 7B is automatically considered an independent variable for processing.

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Table I

Additional Independent Variables of Interest:

1. Age (at time of 1st CHF diagnosis or drug therapy - one of the triple)
2. Gender (M/F)
3. HMO Membership (identification of particular HMO)
4. Site of first CHF diagnosis (site code)
5. Ischemic Heart disease (Y/N)
6. Diabetes (Y/N)
7. Adverse Lifestyle Diagnoses (Y/N)
8. Cardiac Dysrhythmias (Y/N)
9. Other Heart Disease (Y/N)
10. Hypertensive Disease (Y/N)
11. Number of Co-Morbid diseases (0-x)
12. Number of ACE inhibitor prescriptions (0-x)
13. Number of digoxin prescriptions (0-x)
14. Number of loop diuretic prescriptions (0-x)
15. Number of other CV prescriptions (0-x)
16. Number of non-V prescriptions (0-x)
17. Medication Possession Ratio (Compliance measure)
18. Number of CHF hospitalizations
19. Number of CHF emergency services
20. Number of physician office visits
21. Total Costs
    - In-Patient Hospital Costs
    - Emergency Room Costs
    - Doctor Costs
    - Pharmacy Costs
22. Cardiovascular Costs
    - In-Patient Hospital Costs
    - Emergency Room Costs
    - Doctor Costs
    - Pharmacy Costs

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23. CHF Costs

In-Patient Hospital Costs

Emergency Room Costs

Doctor Costs

Turning to the dependent variables, potential dependent variables, for example, contemplated for use with the present invention are results to be predicted. For CHF, such predicted results include:

1. Hospitalization (HL) for CHF. This is a dichotomous variable which is referred to as the HL indicator such that HL = 1 if an admission occurred, otherwise the indicator equals 0.

2. High Cost. For example, the High Cost indicator may be defined as the highest 10% of resource utilization measured in dollars. Resources counted from time of cost in the top 10% of the first CHF diagnosis or receipt of first CHF-related drug (in the record) + 1, 3 and 6 months - separate analyses for each time period. Again, this is a dichotomous variable referred to as the High Cost indicator such that if the patient, for example, is in the top 10%, High Cost = 1, otherwise High Cost = 0.

The High Cost indicator, in the exemplary embodiment, could also be defined as the distribution of total cost per member (PMPM) in the prediction region (B to C). The High Cost indicator is set to 1 for the 10% of members with the highest PMPM in the Total Cost distribution and set to 0 for all others.

3. Death.

Although only three dependent variables for the given example are listed above, as those of ordinary skill in the art will appreciate, other known or yet unknown variables consistent with the goals of the present invention may also suitably serve as a dependent variable within the scope of the present invention.

Turning to the time window aspect of the generation of the analysis file, it should be noted that there is one analysis record for each selected member.

In the present invention, a scheme, as described below, has been developed for defining prediction zones and censoring data to create the analysis file. That is, referring to Figure 9, a time window basically defines a prediction zone or region 910 and an events window (analysis region) 912 from where activity is used to predict something in the prediction zone. As those skilled in

the art will appreciate, additional time window schemes may also adequately serve the present invention.

For purposes of explanation, the time that the claims history covers is referred to as the time window that starts at some point 'A' and ends at point 'C'. The time interval is divided into analysis and prediction regions by point 'B' such that A<B≤C. That is to say, 'B' represents the present. 'A' represents the farthest past event and 'C' represents the farthest future event.

By way of example, Jane Doe's analysis record is based on claims from 1/1/91 through 6/30/93. Therefore, A=1/1/91, C=6/30/93 and B can be selected somewhere in between, such as 12/31/92. Generally, A is defined based on the data extraction protocol (i.e., from when the data is available) and C is defined by the last day for which the member is still enrolled and eligible for the benefits. Of course, variations of those general points of definition could be selected within the scope of the present invention.

The definition of the present instant B is important. In the subject invention, two basic definitions of B were devised in order to maximize the accuracy of the prediction model. Although, as would be understood by those skilled in the art, alternative definitions of B may also be used.

Figure 10A illustrates an exemplary time window scheme, referred to as Scheme 1, for use in processing the data from the event level files shown in Figure 6.

In Scheme 1, the event prediction region is set from B to C such that B=C-(x# of months) for all the members in the analysis. For example, if a 6-month CHF hospitalization (HL) model (i.e., HL is used as a dependent variable) is to be built then B=C-(6 months). In Jane Doe's example, B would equal 12/31/92. Therefore, only data covering from A through B (1/1/91-12/31/92) is used to predict the CHF in the 'next 6 months'. The phrase 'next 6 months' in this context implies that the time point B is "NOW" and any time after it is in the FUTURE and any time before it is in the PAST. This is a key concept of Scheme 1 and is important to understanding the prediction model implementation and application.

In alternative embodiments, analysis weights which reflect proximity to the event to be predicted can be used, for example, within 3 months x 1, 3-6 months x .75, 6-9 months x. .5, 9-12 months x .25, greater than 12 months x .125.

Other suitable weighting techniques, as will be appreciated by those skilled in the art, such as negative weights could also be used. For example, in the exemplary embodiment of the present invention, the actual weighting factor used is $1/e^{-x}$ where x = time in months from point B for each event.

Therefore, given a selected time window scheme and an appropriate set of predetermined variables, the processing step of 650 generates the analysis file.

Returning to Figure 6, once the Analysis files are generated in step 650, the next step, step 660, is to Process Analysis File Using Statistical Data, step 660, which provides the Identified Disease Prediction Model.

Using the analysis file, the model for identification/prediction can then be developed in various ways using statistical techniques. In particular, the analysis file, now at a member level, is processed using statistical functions available in SAS. In the exemplary embodiment of the present invention, the statistical processing performed to generate the prediction model is multiple logistic regression. As will be appreciated by those skilled in the art, other statistical techniques may also be suitable for use with the present invention.

In the exemplary embodiment, the statistical processing, when applied to the analysis file, identifies variables which meet predetermined levels of significance (e.g., probability value < 0.05). These variables then form a prediction model which is a mathematical equation of the following form:

$$\text{Logit}(p) = a + bx_1 + cx_2 \ldots + zx_i$$

where x1...xi are the identified variables and a...z are there parameter estimates. An individual's probability (p) for the outcome under consideration is then determined using the following formula:

$$p = e^{-\text{logit}(p)} / (1+e^{-\text{logit}(p)}).$$

Using the above steps, several experiments were conducted. In one experiment, the results for a model based on Scheme 1 with all commercial members and using the HL indicator as a dependent variable were determined. The resulting independent variables, most likely to predict an adverse CHF health outcome, were 1) hospitalization for CHF, 2) loop diuretics - days supply, 3) hospitalization for hypertension -length of stay, 4) doctor visits for CHF, 5) doctor visits for MI, and 6) ACE inhibitor possession (negative indicator).

In another experiment, the results for a model based on Scheme 1 with all commercial members with no prior CHF hospitalization and using the HL

indicator as a dependent variable were determined. The resulting independent variables, most likely to predict an adverse health outcome, were 1) loop diuretics - days supply, 2) doctor visit for CHF, 3) hospitalization for IHD, 4) doctor visit for IHD, 5) emergency room visit for diabetes, 6) hospitalization for hypertension - length of stay, 7) emergency room visit for lifestyle, 8) hospitalization for other heart diseases, 9) doctor visit for pulmonary conditions. 10) doctor visit for anemia/emergency room visit for anemia, and 11) prescription (Rx) for "other" CV drugs.

In still another experiment, the results for a model based on Scheme 1 with Medicaid members and using the HL indicator as a dependent variable were determined. The resulting independent variables, most likely to predict an adverse health outcome, were 1) hospitalization for CHF, 2) loop diuretics - days supply, 3) doctor visits for CHF, and 4) emergency room visit for diabetes.

An alternative to Scheme 1, and referred to as Scheme 2, is illustrated in Figure 10B which shows a second exemplary time window scheme for use in processing the data from the event level files generated in the present invention.

A difference between Scheme 1 and Scheme 2 is the definition of the prediction region for members which have at least one identified disease hospitalization or emergency room visit (HL/ER). The prediction region starting at point B, in Scheme 2, is defined in multiple passes over each member's record. Turning again to Jane Doe's analysis record (from 1/1/91 through 6/30/93, A=1/1/91, C=6/30/93) to illustrate how this aspect works for defining point B, assume that Jane Doe was hospitalized for depression three times: on 4/1/91, 4/1/92, and 4/1/93.

Point B is set equal to the date of the first identified disease HL/ER - 1 month or set equal to point C if a member never had the identified disease HL/ER in their claims history. For Jane Doe, B=4/1/91. In the exemplary embodiment of the present invention, moving back one month from the HL date is performed to simulate the model application environment. There would probably be at least 30-day lag from model scoring to the disease management actions based on the scoring reports. Thus, in Jane Doe's record B=4/1/91-(1 month)=2/28/91. Jane's record, in this case, would not be used in the model building because the time span of the analysis region is only two months--less than the exemplary six month data history requirement.

Repeating steps 1 and 2 using second (or third or...) HL date to set point B, Jane Doe's record would eventually make it into model building on the second and third pass. This process, in the exemplary embodiment, terminates after three or four passes since there would probably be very few members with five or more identified disease HL/ERs in the study population.

It should be noted that the consequence of repeated modeling introduces added complexity of setting up additional independent variables. An important advantage, however, of Scheme 2 is that the prediction HL/ER rate would likely be higher than in Scheme 1.

In still another alternative embodiment, analysis weights which reflect proximity to the event to be predicted can be used, for example, within 3 months x 1, 3-6 months x .75, 6-9 months x. .5, 9-12 months x .25, greater than 12 months x .125. Other suitable weighting techniques, as will be appreciated by those skilled in the art, could be used. These type of weighting techniques may be used with either Scheme 1 or Scheme 2.

It should be noted that each of the experimental results indicate a different number of independent variables are used for the specific prediction models; and, depending on the precision of the models desired, more or fewer independent variables may be used based on their individual ability to accurately predict the selected dependent variable.

Risk Stratification and Generation of Intervention Lists

Next, the determined prediction model is applied to the client specified data. The determined model can be applied to the existing data, to the data as it is regularly updated or to other claims databases for other benefits providers. To do so, only the determined independent variables of interest need to be processed. Of course, as new claims databases are to be analyzed, the entire process can be repeated to generate a new model in order to determine if other variables may be better predictors.

The output generated by applying the model is a file containing a list of all of the patients having the identified disease ordered by an indicator representative of the likelihood that that patient will have an adverse health outcome (i.e., experience that is defined by the dependent variable). This list can then be divided, for example, into subgroups such as in 5% or 10% increments of patients likely to have the adverse health outcome.

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Model performance can now be assessed by determining the number of actual adverse health outcomes occurring in the prediction window for each 5% or 10% subgroup.

Applying the model to future claims data or other databases of identified disease patients or building a new model in a new database as described above, patients with an identified disease at high risk can be identified allowing for various types of intervention to maximize the effective allocation of health care resources for these patients. The Risk Stratification (RS) process 140 is required to generate such lists of patients, and the Intervention Management process 160 receives these lists and initiates interventions with the patients with the identified disease. These processes are described in more detail below. Such interventions may take the form of 1) specific case management, 2) novel interventions based on subgroup characteristics, 3) high risk intervention, 4) high (relative) cost intervention, or 5) plan modification all adhering, of course, to the best practice guidelines.

Referring to Figure 1B, the Risk Stratification (RS) process 140 is required to support the Disease Management system by providing the Intervention Management process 160 with a list of patients who are at-risk of an adverse health outcome for an identified disease. This list of patients is called the Intervention List.

Figure 11 shows a high level flowchart showing the Risk Stratification process 140 including a RS Front End (FE) 1110 module, a RS Mining Engine (ME) 1112 module, and a RS Database 1118. These two modules collaborate to produce intervention lists from the RS Database 1118.

The RS Front End (FE) 1110 allows end users to enter all of the information necessary to maintain and run disease programs for clients.

The RS FE 1110 of the present invention is written using Delphi 2.0, which is a 32 bit software development tool. The RS FE 1110 stores client and disease parameters in Sybase System 11 running on a Windows NT or UNIX based server. The RS FE 1110 uses the Borland 32 Bit Sybase SQL Links database drivers. However, it is contemplated that the present invention can be practiced using any similar development and database tools and is not limited to this configuration.

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The RS Mining Engine (ME) 1112 runs the scheduled client identified disease programs yielding intervention lists that are provided to the Intervention Management process 160 of Figure 1B. The RS ME 1112 is a batch/daemon process and follows this basic program logic:

A. Run nightly (batch) or as a daemon process

B. Determine what client identified disease programs need to run based on schedule and available data

C. For every scheduled client disease program:

a) Get disease program rule components.

b) Get disease program parameters for each rule component.

c) Validate that the necessary data streams (R_x, M_x and Lab) exist for the identified disease program

d) Initialize the scheduled client identified disease program

e) Execute the scheduled client identified disease program

f) Provide intervention lists to the Intervention Management process 160

D. Terminate (batch) or set process to sleep (daemon)

The RS ME 1112 is written using Delphi 2.0, which is a 32 bit software development tool. The RS ME 1112 processes disease parameters provided by the RS FE 1110 combined with client pharmacy claims, medical claims and laboratory test information for specific disease programs producing specific intervention lists all of which are retrieved from or stored in a relational database. The RS ME 1112 utilizes the Sybase System 11 database running on a Windows NT or UNIX based server. The RS ME uses the Borland 32 Bit Sybase SQL Links database drivers. However, it is contemplated that the present invention can be practiced using any similar development and database tools and is not limited to this configuration.

The operation of the Risk Stratification process of Figure 11 is now described. End users, which may either be coupled to the Case Management process 150 of Figure 1B or another separate entity, provide end user identified disease program information to the RS FE 1110. The RS FE records information

for the setup of new identified diseases, new disease programs, predictive models and rules, client specific parameters, disease specific rule parameters, and new clients; and the RS FE 1110 associates disease programs with clients, schedules disease programs, and runs informational reports. The RS FE 1110 records this information as a "disease program" in a format for use by the RS ME 1112.

The disease program is provided by the RS FE 1110 to the RS database 1118, and the RS database 1118 also receives predictive model and rule information from the Predictive Modeling process 130. Finally, the Disease Management database 120 provides patient medical information to the RS database 1118 for the RS ME 1112 when the RS ME 1112 applies the predictive model to the patient data. Finally, the RS ME 1112 receives the information contained in the RS Database 1118 as the RS ME executes the disease program data and applies the predictive model to the patient data.

Figure 12 is a high level flowchart showing the RS ME 1112 of the Risk Stratification process of the present invention. The RS ME 1112, as shown in Figure 12, is composed of three major sub-systems: a RS Schedule Manager (SM) 1210, a RS Rule Manager (RM) 1214 and a RS Intervention List Manager (ILM) 1216. Each of the three sub-systems interacts with the RS Database 1118, which can be a subset of the Disease Management database 120 of Figure 1B, containing client and identified disease program analytic configurations.

The Disease Management database 120 is regularly updated with patient information (Member, Eligibility, Pharmacy (R_x) Claims, Medical (M_x) Claims and Clinical Laboratory (Lab) Claims) for each client. Consequently, the RS Database 1118 is also updated regularly with client and client member information. The RS ME 1112 gathers relevant client patient information from the Disease Management Database 120 to be processed by the disease program analytic rules. In the exemplary embodiment of the invention, all relational databases are SYBASE System 11.

The RS SM 1210 compiles a list of identified disease programs to execute by examining each enrolled client to see if the schedule time has arrived for the program to execute. Additionally, client disease programs must be approved for execution by the RS ME 1112 before they may be scheduled. Approval indicates that all client disease program parameters are entered and that the data entered has been validated by the RS FE 1110 and is ready to be

processed in the RS ME 1112. Finally, the RS SM 1210 verifies that all required data streams are available. The RS ME 1112 may be a batch program that is executed periodically. For each identified disease program which is selected by the above logic, an RS RM object is created. RS RM objects are executed sequentially.

The RS RM 1216 then assembles the rules required to implement the specific identified disease program into an ordered sequence. These rules are described in detail subsequently, and are provided by the Predictive Modeling process 130 and the Case Manager 150. Each rule object is initialized with disease program and client specific rule arguments. Rules sequences desirably contain one or more Common rules and one or more sequence of rules called Patient Group Classifiers (PGCs). PGCs are used to stratify a targeted client patient population into specific groups for intervention or reporting based on specific criteria. All interventions and reporting is performed based on patient membership in one or more of the disease program PGCs.

Common rules are executed in the specified order prior to any PGCs. In general, rules are designated as common rules because they either prepare the environment for other rules (Client Participation, R_x Claims, M_x Claims, etc.) or they perform exclusions that reduce the overall patient set size prior to being acted upon by other complex rules (Patient Active, Patient Age, Patient Gender, etc.), thus improving overall performance. Patients who 'fail' the specified rules are removed from the patient set.

PGCs are executed in parallel with the rules in each PGC also being executed in parallel on the patient set provided by the common rules. PGC rules use a tally mechanism for each patient in the set to indicate passage or failure of the specified rule for that patient.

Upon completion of all PGCs the RS ILM 1216 scores each patient for membership in each PGC. The RS ILM 1216 then generates and stores intervention lists for later processing by the Intervention Management process 160.

The RS SM 1210 initially queries the RS Database 1118 at startup of batch process or periodically if running as a daemon to determine if the approved client identified disease programs scheduled run date has arrived and if all required client data streams are up to date. If all required data streams are

available, a Rule Manager (RM) object is created for each client disease program.

Identified disease program attributes are stored in a table. One attribute is the approval status. Each identified disease program is desirably approved before it is scheduled. If any identified disease programs are scheduled, then the disease program approval may not be revoked.

Determining which programs require execution and when is accomplished via a schedule table which contains, among other things, a status and a scheduled run date. Once the scheduled date is reached the program is executed and the status is updated to running.

The RS RM 1214 is responsible for running and managing the results of a single disease program.

The rules are grouped according the Patient Group Classifier (PGC) that they are assigned to. First all the common rules (those without a PGC) are run. Then the rules for each PGC which exists in the disease program are run

The RS ILM 1216 evaluates each client disease program that successfully executed and compiles a listing in a intervention candidates table of the members selected by the program as belonging to each PGC within that program.

A member is included in a PGC if the member has not been deleted from the set by any common rule, and the member's output for each PGC rule matches the desired value (1 for non-negated rules and null for negated rules).

Members who are included in a PGC are populated into an interventions table, which can also be the intervention list. This table includes identifying information for the member selected, the program run, the PGC in which the member was included, and the physician which was identified if the Physician Identification Rule was used.

Rules - General Classification

A rule classified as a "Root Rule" indicates that the rule is required to run before all others and performs certain environment initializations for all other rules. Every identified disease program must have one and only one root rule. Currently, the only root rule is Client Participation.

A rule classified as a "Common Rule" indicates that the rule is eligible to be executed prior to any PGC. Members who 'fail' common rules are removed

from the patient set. A rule can be simultaneously eligible to be executed as a common rule and a PGC rule.

A rule classified as a "PGC Rule" indicates that the rule is eligible to be executed after common rules in parallel. Members who 'pass' PGC rules are marked in a column specifically added for that rule in a table. A rule can be simultaneously eligible to be executed as a common rule and a PGC rule.

The rule "Creates Pharmacy Claims" creates a table for pharmacy claims. Every identified disease program that uses pharmacy claims for a data source desirably has a rule that performs this function prior to rules that use pharmacy claims.

The rule "Creates Medical Claims" creates a table for medical claims. Every identified disease program that uses medical claims desirably has a rule that performs this function prior to rules that use medical claims.

The rule "Creates Clinical Test Data" creates a table for clinical test data. Every disease program that uses laboratory claims desirably has a rule that performs this function prior to rules that use laboratory claims.

The rule "Uses Specialties" uses physician specialty information.

The rule "Uses Pharmacy Claims" uses the table containing pharmacy claims information.

The rule "Uses Medical Claims" uses the table containing medical claims information.

The rule "Uses Clinical Test Data" uses the table containing clinical test information.

All the rule objects in the RS ME 1112 are descended from a common ancestor which provides some basic functional structure shared by all rules

Rules - Selection Rules and Intervention Rules

The present embodiment of the RS ME 1112 supports various selection and intervention rules:

1) Client Participation Rule

Identifies whether a patient is part of a group that has been enrolled into the disease management program. This rule will ensure that all patients considered by the following rules are part of a group that the client wishes to have participate in the program. This rule may also validate that the patient has the proper benefit structure to permit the disease program to function. Client

Participation is currently the only root rule. It is desirably, therefore, the first rule in every disease program. It is always executed as a common rule.

2) R_x Claim Rule

This rule selects all pharmacy claims data that is applicable to the execution of a single identified disease program. It identifies all pharmacy prescription claims selected for a specific drug group within a specified analytic time frame. The R_x Claim rule is always a common rule. It is typically only run once in a given program.

3) Existence of a Specific Drug Rule

This rule identifies members with at least one claim for a drug in the specified drug group within the rule time frame. This rule may be run as either a common or a PGC rule.

4) Recurrent Patient Rule

This rule identifies whether a patient has a pattern of drug use which indicates the potential of multiple independent episodes (recurrence) of a disease. The rule will select patients with at least a certain number of discrete episodes of a particular drug therapy. This rule may be run as either a common or a PGC rule.

5) Stoppage in Current Therapy Rule

This rule identifies patients whose drug therapy for a particular drug group has been stopped. This is determined based on the last prescription for a drug in that drug group. This rule may be run as either a common or a PCG rule.

6) Patient Age Rule

This rule identifies patients whose ages fall within a specified target range. This rule may be run as either a common or a PGC rule.

7) Minimum Patient Eligibility Rule

This rule identifies whether a patient is eligible for medical and/or drug benefits for a specified continuous period of time. This rule may be run as either a common or a PGC rule.

8) Patient Active Rule

This rule verifies that a member is active and in a group which is included in the program at the time of intervention. This rule may be run as either a common or a PGC rule.

9) Average Puff Equivalence Rule

This rule identifies whether a member has the required average puff equivalence of drug therapy during a specified time frame. This rule may be run as either a common or a PGC rule.

10) Count of Occurrences Rule

This rule identifies whether a patient has a selected range of occurrences on different filled dates for a specified drug therapy. This rule may be run as either a common or a PGC rule.

11) Patient Gender Rule

This rule identifies members of a particular gender. This rule may be run as either a common or a PGC rule.

12) Dose Level Recurrence Rule

This rule identifies whether a patient has a pattern of drug use within a specified dose range which indicates the potential of multiple independent episodes (recurrence) of the disease at the same or similar severity. This rule may be run as either a common or a PGC rule.

13) Continuous Therapy at Required Dose Level Rule

This rules identifies patients who have continuous drug therapy within a specific dose range for a specified length of time. This rule may be run as either a common or a PGC rule.

14) Concurrent Therapy Rule

This rule identifies patients who have overlapping therapy of at least a given duration for the specified drug groups. This rule may be run as either a common or a PGC rule.

15) Dose Level Rule

This rule identifies patients who have R_x Claims for a specified drug therapy within a specified dose level range. This rule may be run as either a common or a PGC rule.

16) Drug Usage Level Rule

This rule identifies members whose drug usage relative to expected values is within a specified range. Typically, this rule will be used to determine members who are non-compliant with a specified drug therapy. This rule may be run as either a common or a PGC rule.

17) Weighted Existence of Specific Drug Rule

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This rule identifies members whose drug therapies fall within a designated risk score range. Each drug therapy is assigned a risk score and a member's drug history is assessed to determine his/her accumulated risk score. This rule may be run as either a common or a PGC rule.

18) Physician Identification Rule

This rule selects the specific Prescriber to send communication regarding a member who has been identified for intervention. This selection is based on the Pharmacy Claim data for that member and/or information about the member's primary care physician which may be found in the Member data in the Patient Data Repository 120. This rule may be run as either a common or a PGC rule.

19) All Member Rule

The All Member Rule selects all members present in the record set. This is used to support a PGC which contains all members selected by the common rules. This rule may also be used internally by the RS ME 1112 in order to support certain types of disease program optimization. This rule may only be used as a PGC rule.

Appendix VI includes a list and description of the selection rules as used in one embodiment of the invention. It should be apparent to those skilled in the art that these rules can be modified or deleted, and new rules created for a particular embodiment of the invention.

Intervention Management Process

Once again referring to Figure 1B, the Risk Stratification process 140 outputs the Intervention List to the Intervention Management process 160 to initiate specific interventions. Interventions may include initial offerings, fully administered disease programs, forwarding educational materials, inbound or outbound telecommunications, faxes, Email or Voice Response interactions with member patients identified on the Intervention list. The Intervention Management process 160 provides the intervention information to the Intervention Records and Tracking process 170, which records the interventions to determine if proactive disease management services improve specific disease outcomes.

Figure 13 is a high level diagram of the Intervention Management process 160 of the present invention, and the intervention process, called an intervention program, is performed on an intervention list of client members having an identified disease. The Intervention Management process 160 shown in

Figure 13 includes Program Initiation 1310, which starts the intervention program; Enrollment 1320, which enrolls identified patients into the intervention program; Intervention 1330, which initiates the intervention with the enrolled patient; and Analysis 1340, which analyzes the results of an intervention with a patient.

The Intervention Management process 160 is provided data by the Disease Management database 120 as well as the intervention list from the Risk Stratification process 140. This data feed or detection process has parameters that identify a specific patient meeting the conditions for participating in a disease program. This detection process provides a population for consideration in the specific disease program under the following conditions:

1) The Disease Management database 120 provides client's updated identified disease patient data to the intervention management system on a scheduled basis.

2) The Intervention Recording and Tracking process 170 passes intervention contact data back to the Disease Management database 120. This intervention data is stored there for use in the analytic process.

3) The Intervention Management process 160 detects, selects and passes new intervention data on "adds" which are defined as new enrollees, changes in disease detection, subsequent diagnosis or an individual enrollment request from an intervention manager.

4) The Intervention Recording and Tracking Process 170 revises patient data on those individuals previously selected for the program. Data revisions occur when personal or medical data changes. For example, additional medical or pharmacy claims are received or additional laboratory reports are secured.

Referring to Figure 13, the first step of the process is program initiation, step 1310. Program Initiation is a process where a disease program is initiated through the process of selection of a population of patients based on predefined criteria and the initial interventions are sent. Upon selection specific predefined program activities take place.

A sample initiation might be that 1) a letter is sent, on behalf of the patient, to their physician informing them of this patient's identification into the program, the disease protocols and the recommended actions from the physician. 2) Intervention Management data is passed from the Disease Management

database 120 to the Intervention Management system 160 and is loaded. 3) An initial "contact segment" is added for the patient indicating the sending of the physician letter.

Another sample initiation might be: 1) a letter is sent to the patient, with a copy to their physician informing them of their inclusion in the disease program. 2) The patient may be requested to call into a Voice Response System to answer specific questions. 3) The contact is added and the responses analyzed for further processing.

The second step of the process is the Enrollment step 1320. In this step the Patients are enrolled into the program. Patients are enrolled into the Disease Management service through interfaces to the Intervention Management System. These interfaces can be through a Voice Response System, written letter return or a direct call. The enrollment process triggers the scheduling of an intervention event within the intervention management system.

The next step is the Intervention process 1330, which is the process of interceding with a physician and client for the purposes of: 1) ensuring compliance with a course of treatment, 2) providing disease educational material to both the patient and physician, 3) providing emergency assistance from a distance, 3) logging each and every intervention as a "contact" to provide assistance in determining program effectiveness and to establish a framework to make mid-course adjustments to the program, and 4) providing data back to the product managers on program effectiveness.

The last step is the analytic process 1340 which assimilates disease information for the purposes of determining disease management service success. Although the intervention management system does not produce the analytic reporting, critical information is passed back during this process to the Disease Management Database 120 for processing.

While the invention has been described in terms of an exemplary embodiment, it is contemplated that it may be practiced as outlined above with modifications that are within the scope of the following claims.

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What is Claimed:

1. A computer-implemented method for disease or condition intervention management using information about patients existing in at least one database, said method comprising the steps of:

a) processing, based on predetermined criteria, the patient information in the database to extract patient information for a group of patients relating to an identified disease or condition;

b) defining a predictive model, including:

i) defining, using the information available in the database, a set of events or data relevant to the identified disease or condition;

ii) converting the extracted patient information and the defined events or data into files comprising event-level information;

iii) defining a time-window for providing a timeframe from which to judge whether specific ones of the defined events should be considered in subsequent processing;

iv) identifying a set of variables as potential predictors;

v) processing the event-level information, using the time-window and the set of variables, to generate an analysis file;

vi) performing statistical analysis on the analysis file to generate the prediction model and a set of rules for use in identifying at-risk patients diagnosed with or who may develop the identified disease or condition, said prediction model and rules being a function of a subset of the set of variables;

c) applying the prediction model and the rules to the same or new set of event-level information to identify at-risk patients for the identified disease or condition, or to identify patients who may be at risk for developing the identified disease or condition;

d) preparing an intervention list from the identified at-risk patients and selecting, for at least one at risk patient, an intervention;

e) distributing or facilitating the distribution of the intervention to said patient; and optionally

f) recording and tracking an intervention result for each at-risk patient based on the respective selected intervention; and optionally

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g) updating the historical data in at least one database with each intervention result corresponding to said database: and

h) repeating step b(ii); and

I) re-applying the prediction model and rules to the event-level information extracted from the data in the updated database.

2. A computer-implemented system for disease management using information about patients existing in a database, said system comprising:

a) processing means for processing, based on predetermined criteria, the patient information in the database to extract patient information for a group of patients having an identified disease or condition;

b) means for defining a predictive model, including:

i) event definition means for defining, using the information available in the database, a set of events relevant to the identified disease or condition;

ii) conversion means for converting the extracted patient information and the defined events into files containing event-level information;

iii) means for defining a time window for providing a timeframe from which to judge whether specific ones of the defined events should be considered in subsequent processing;

iv) means defining a set of variables as potential predictors;

v) means for processing the event-level information, using the time window and the set of variables, to generate an analysis file;

vi) means for performing statistical analysis on the analysis file to generate the prediction model and a set of rules for use in identifying at-risk patients diagnosed with the identified disease, said prediction model and rules being a function of a subset of the set of variables;

c) means for applying the prediction model and the rules to the same or new set of event-level information to identify at-risk patients for the identified disease or condition;

d) means for forming an intervention list from the identified at-risk patients and selecting, for at least one at risk patient, an intervention;

e) means for distributing or facilitating the distribution of the intervention to said patient; and optionally

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f) means for recording and tracking an intervention result for each at-risk patient based on the respective selected intervention; and

g) means for updating the historical data in at least one database with each intervention result corresponding to said database or creating a mirror database using the data obtained in step f); and

h) means for repeating step b(i); and

i) means for re-applying the prediction model and rules to the event-level information extracted from the data in the updated database.

3. A process for preparing a health intervention product from patient information in a computer database said process comprising:

a) using a computer for extracting and processing, based on predetermined criteria, the patient information in the database to obtain a data file of patient information for a group of patients having an identified disease or condition;

b) programming a predictive model into a computer wherein the model constructed includes the steps of:

i) defining, using the information available in the database, a set of events relevant to the identified disease or condition;

ii) converting the extracted patient information and the defined events into files containing event-level information:

iii) applying a time window for providing a timeframe from which to judge whether specific ones of the defined events should be considered in subsequent processing;

iv) entering a set of variables as potential predictors;

v) generating an analysis file by processing the event-level information, using the time window and the set of variables;

vi) performing statistical analysis on the analysis file to generate the prediction model and a set of rules for use in identifying at-risk patients diagnosed with the identified disease or condition, said prediction model and rules being a function of a subset of the set of variables; then

on a computer:

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c) running the prediction model and the rules against the same or new set of event-level information to identify at-risk patients for the identified disease or condition;

d) outputting an intervention list from the identified at-risk patients and selecting, for at least one at risk patient, an intervention;

e) distributing the intervention to said patient; and optionally

f) recording and tracking an intervention result for each at-risk patient based on the respective selected intervention; and

g) updating the historical data in at least one database or creating a new database with each intervention result corresponding to said database; and

h) re-running step b(i); and

i) re-running the prediction model and rules against the event-level information extracted from the data in the database created in step g; and optionally

j) outputting an intervention list obtained by re-running the prediction model and the rules against the database created in step g.

4. A health intervention product made by the process of:

a) using a computer for extracting and processing, based on predetermined criteria, the patient information in the database to obtain a data file of patient information for a group of patients having an identified disease or condition;

b) programming a predictive model into a computer wherein the model constructed includes the steps of:

i) defining, using the information available in the database, a set of events relevant to the identified disease or condition;

ii) converting the extracted patient information and the defined events into files containing event-level information;

iii) applying a time window for providing a timeframe from which to judge whether specific ones of the defined events should be considered in subsequent processing;

iv) entering a set of variables as potential predictors;

v) generating an analysis file by processing the event-level information, using the time window and the set of variables;

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vi) performing statistical analysis on the analysis file to generate the prediction model and a set of rules for use in identifying at-risk patients diagnosed with the identified disease or condition, said prediction model and rules being a function of a subset of the set of variables; then

on a computer:

c) running the prediction model and the rules against the same or new set of event-level information to identify at-risk patients for the identified disease or condition;

d) outputting in hard copy or machine-readable form an intervention list from the identified at-risk patients and selecting, for at least one at risk patient, an intervention;

e) distributing the intervention to said patient; and optionally

f) recording and tracking an intervention result for each at-risk patient based on the respective selected intervention; and

g) updating the historical data in at least one database or creating a new database with each intervention result corresponding to said database; and

h) re-running step b(i); and

i) re-running the prediction model and rules against the event-level information extracted from the data in the database created in step g; and optionally

j) outputting an intervention list obtained by re-running the prediction model and the rules against the database created in step g.

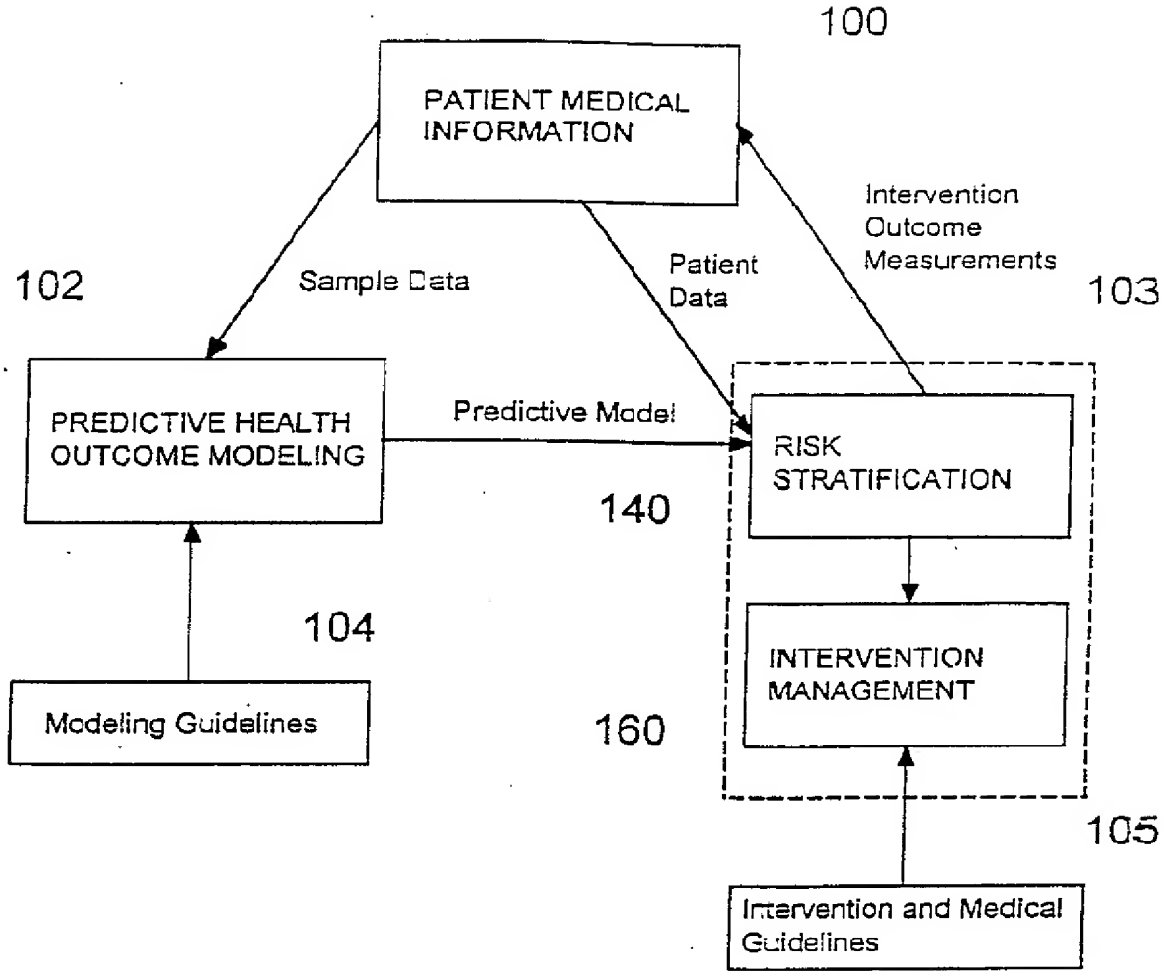
100
PATIENT MEDICAL INFORMATION
Intervention Outcome Measurements
102
Sample Data
Patient Data
103
PREDICTIVE HEALTH OUTCOME MODELING
Predictive Model
RISK STRATIFICATION
140
104
INTERVENTION MANAGEMENT
Modeling Guidelines
160
105
Intervention and Medical Guidelines

Figure 1A

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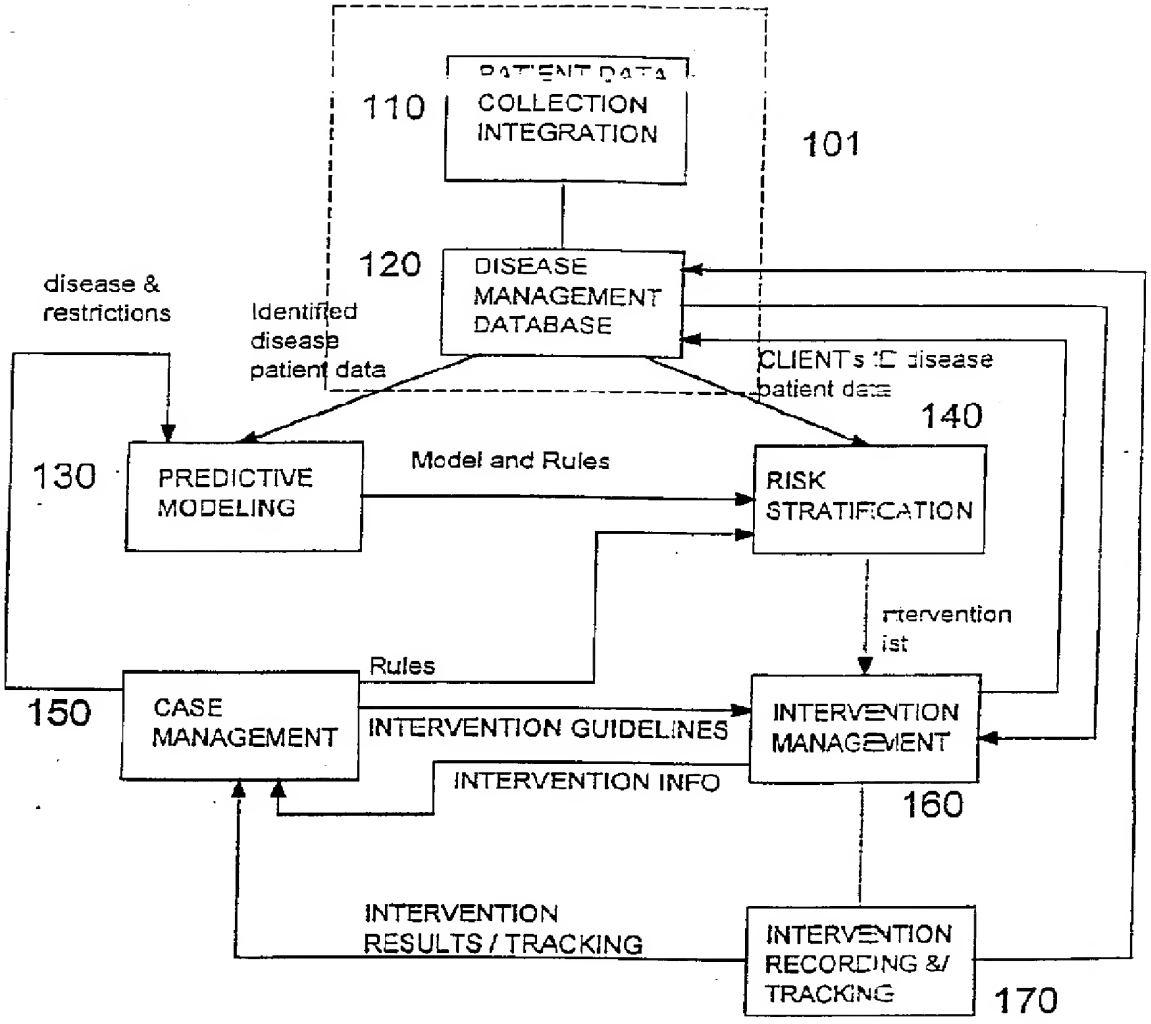

FIGURE 1B

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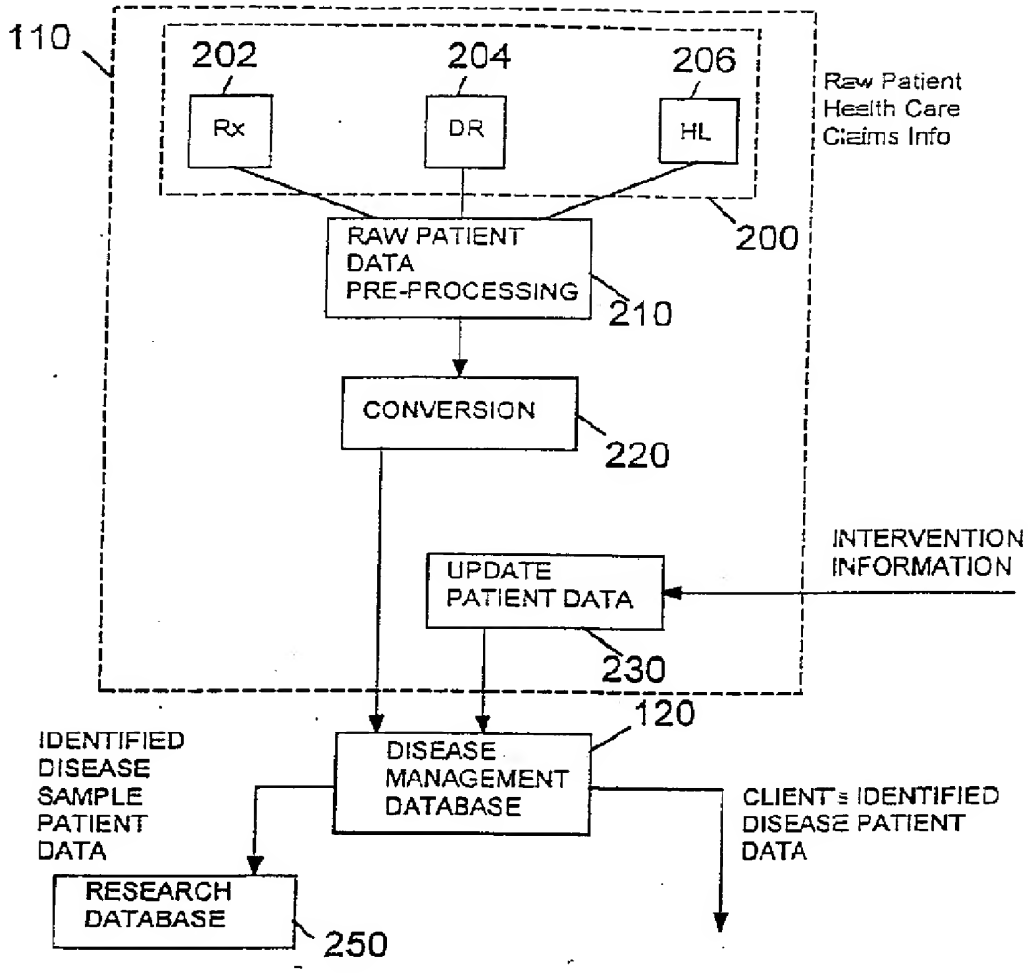

FIGURE 2A

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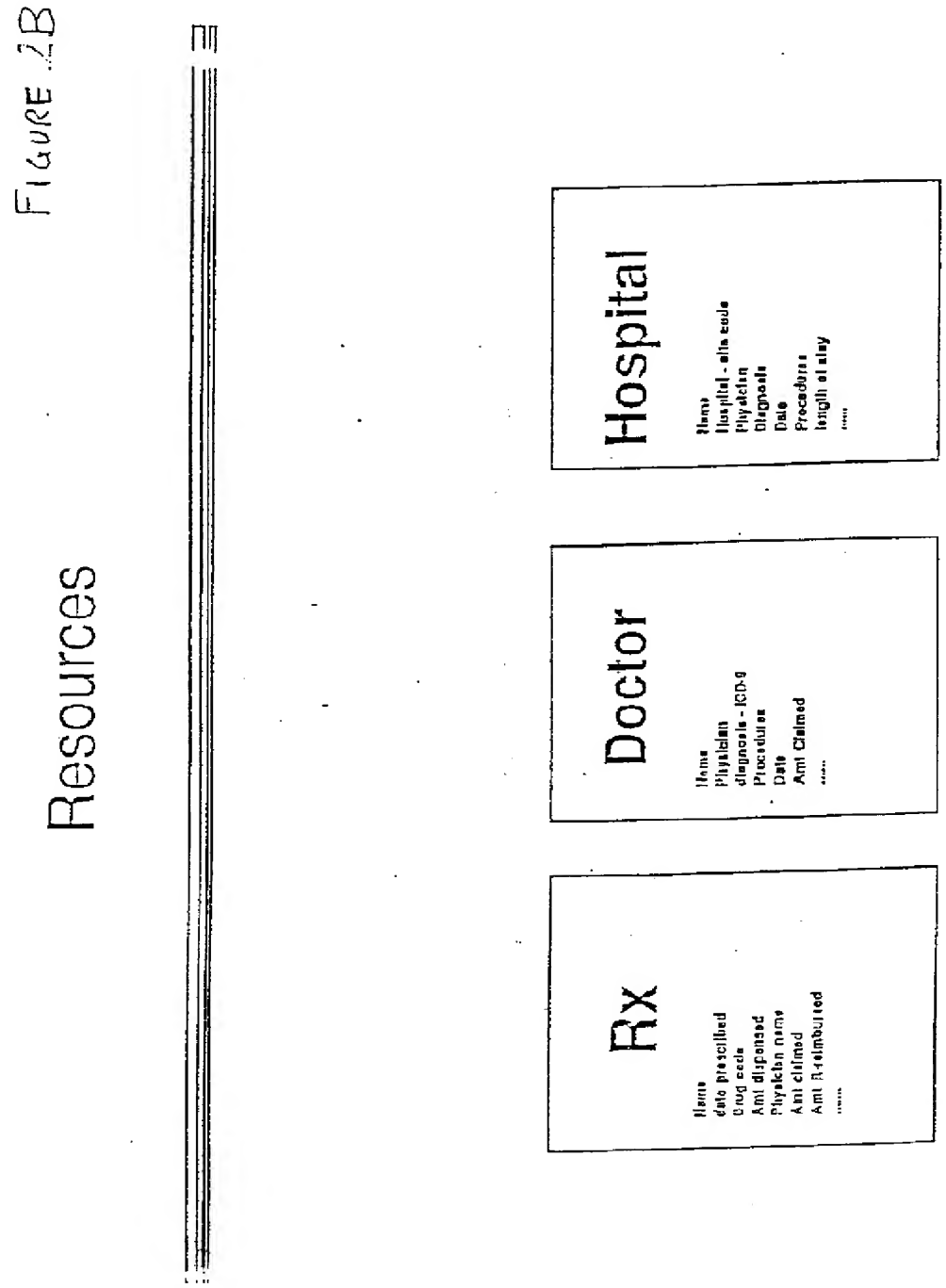
FIGURE 2B



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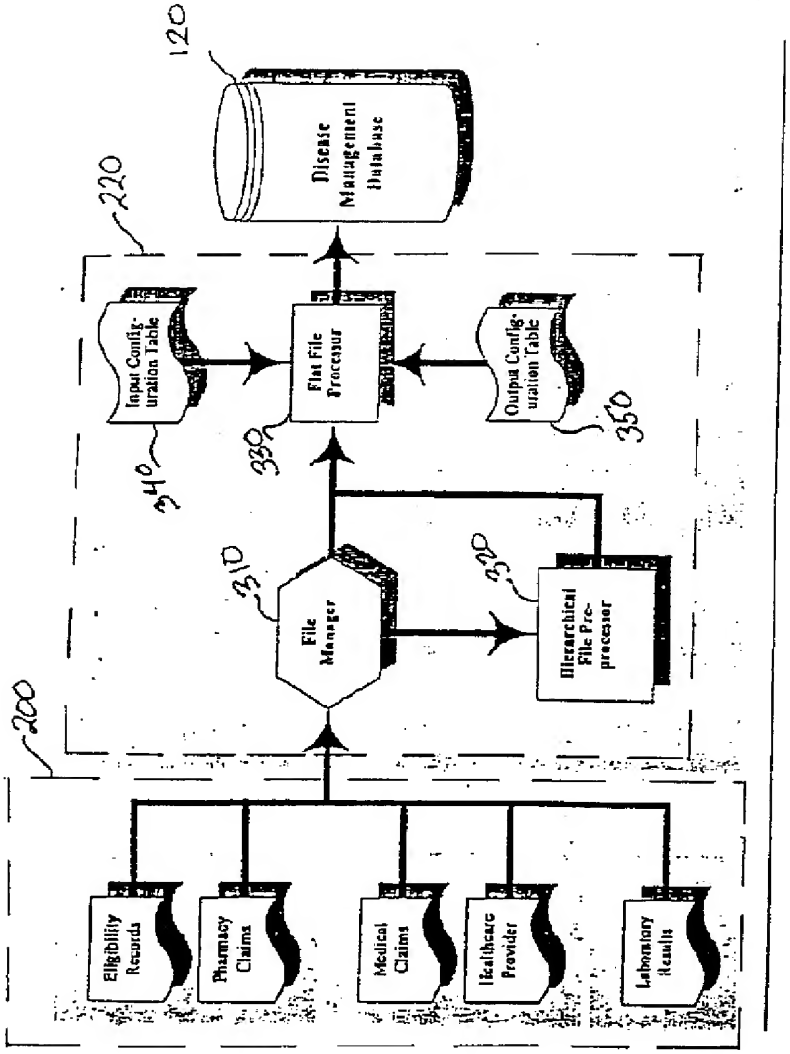

FIGURE 3

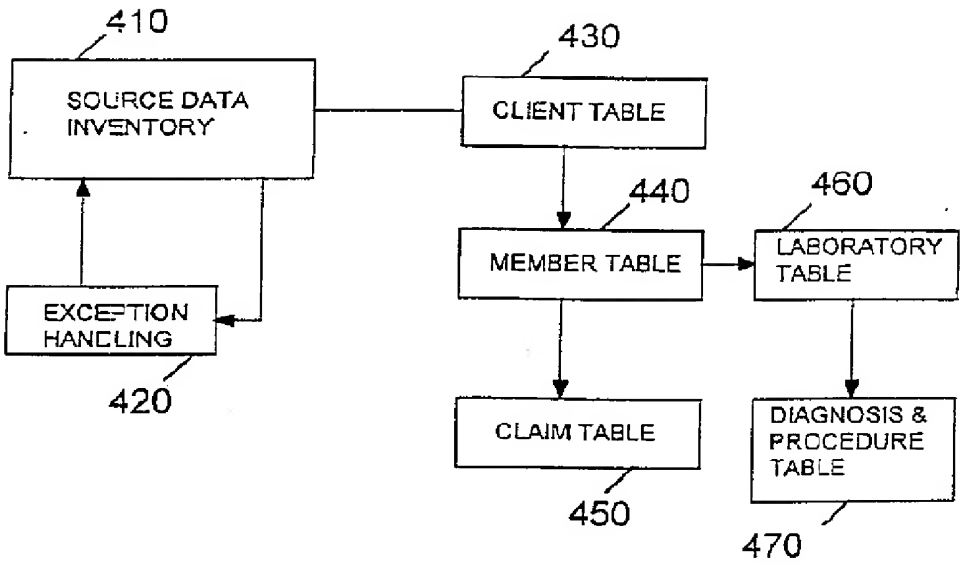
410
SOURCE DATA INVENTORY
430
CLIENT TABLE
440
MEMBER TABLE
460
LABORATORY TABLE
EXCEPTION HANDLING
420
CLAIM TABLE
450
DIAGNOSIS & PROCEDURE TABLE
470

FIGURE 4

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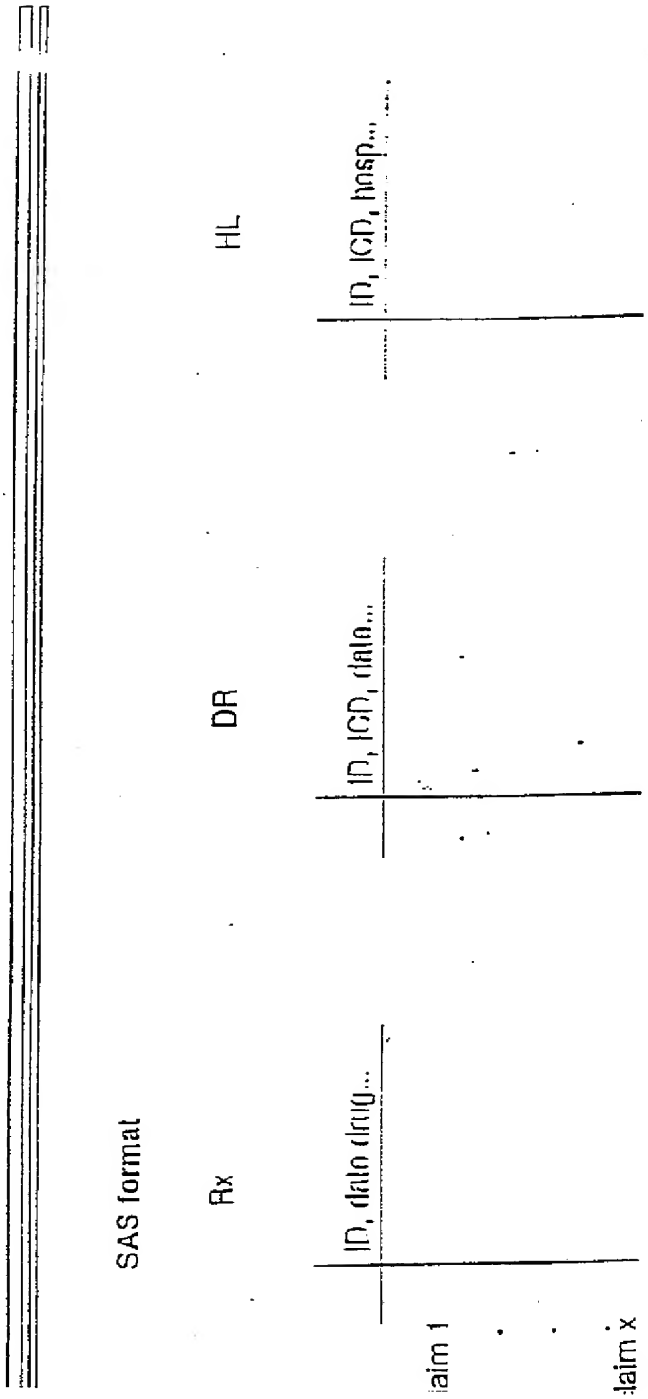
Figure 5



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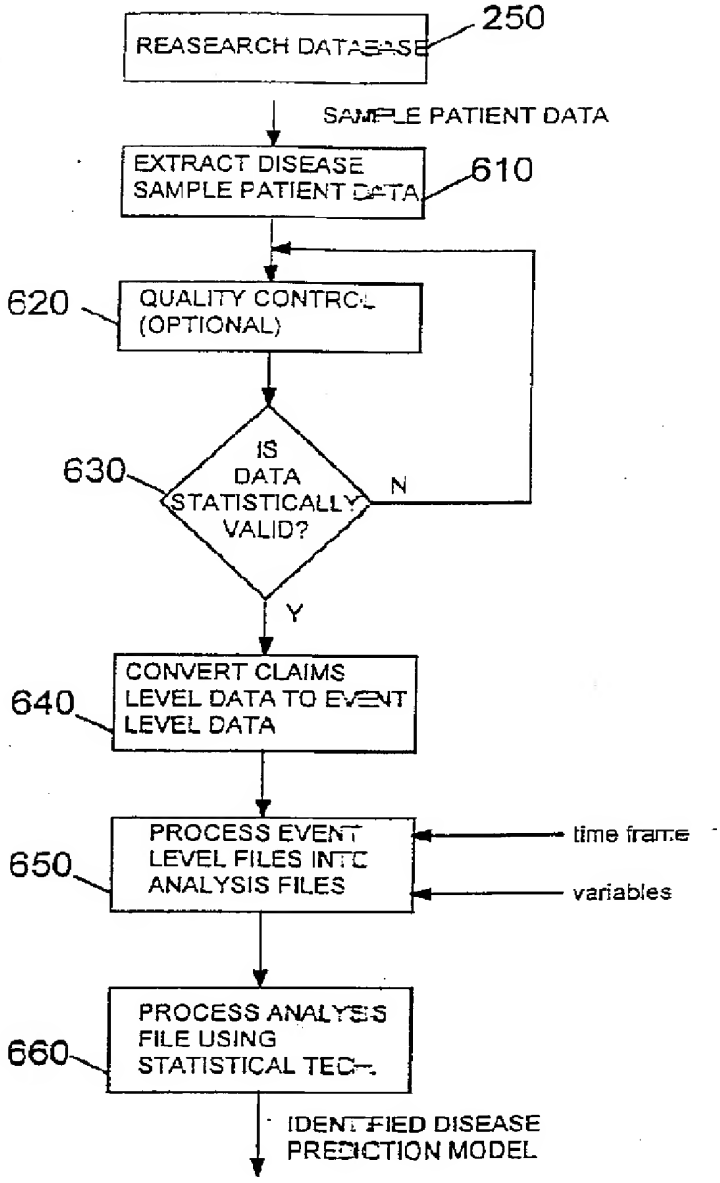

FIGURE 6

	Event	Event date	Number	cost	Category indicator
1	Hospitalization for depression	date	LOS	$	severity
2	Emergency room for depression	date	blank	$	blank
3	Doctor (outpatient) visit for depression	date	blank	$	specialist
4	Prescription for SSRI	date	days supply	$	therapy class
5	Prescription for TCA	date	days supply	$	therapy class
6	Prescription for other neuroactive drug	date	days supply	$	sub-class
7	Procedure for depression	date	blank	$	sub-class
8	Hospitalization not for depression	date	LOS	$	severity
9	Emergency Room not for depression	date of first	number in month	$	
10	Doctor (outpatient) visit not for depression	date of first	number in month	$	
11	Prescription for possibly related drugs	date of first	number in month	$	
12	Prescription for non-depression drugs	date of first	number in month	$	
13	Procedure not for depression	date of first	number in month	$	Severity indicator

FIGURE 7A

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Event	Event date	Number	Cost	Category Indicator
1. CHF ER	date	NA	$	NA
2. CHF Hospitalization	date	LOS	$	NA
3. CHF office visit	date	NA	$	NA
5. IHD Hospitalization	date	LOS	$	subclass
6. IHD office visit	date	NA	$	subclass
7. Diabetes ER	date	NA	$	NA
8. Diabetes Hospitalization	date	LOS	$	NA
9. Diabetes office visit	date	NA	$	NA
10. Dysrhythmia ER	date	NA	$	NA
11. Dysrhythmia Hospitalization	date	LOS	$	NA
12. Dysrhythmia office visit	date	NA	$	NA
13. Hypertension ER	date	NA	$	NA
14. Hypertension Hospitalization	date	LOS	$	NA
15. Hypertension office visit	date	NA	$	NA
16. Lifestyle ER	date	NA	$	NA
17. Lifestyle Hospitalization	date	LOS	$	NA
18. Lifestyle office visit	date	NA	$	NA
19. Other Hrt Dz ER	date	NA	$	NA
20. Other Hrt Dz Hospitalization	date	LOS	$	NA
21. Other Hrt Dz office visit	date	NA	$	NA
22. Respiratory ER	date	NA	$	NA
23. Respiratory Hospitalization	date	LOS	$	NA
24. Respiratory office visit	date	NA	$	NA
25. Thyrotoxicosis ER	date	NA	$	NA
26. Thyrotoxicosis Hospitalization	date	LOS	$	NA
27. Thyrotoxicosis office visit	date	NA	$	NA
28. Pulmonary Embolism ER	date	NA	$	NA
29. Pulmonary Embolism Hosp.	date	LOS	$	NA
30. Pulmonary Embolism office	date	NA	$	NA
31. Anemia ER	date	NA	$	NA
32. Anemia Hospitalization	date	LOS	$	NA
33. Anemia office visit	date	NA	$	NA
34. Infection ER	date	NA	$	NA
35. Infection Hospitalization	date	LOS	$	NA
36. Infection office visit	date	NA	$	NA
37. Other ER	date of first	# ER in month	$	NA
38. Other Hospitalization	date of first	# hosp in month	$	NA
39. Other office visit	date of first	# OV in month	$	NA
40. Miscellaneous Medical event	date of first	# in month	$	# of CV in month
41. Routine CV Procedures	date of first	# on event date	$	NA
42. Intermediate CV Procedures	date of first	# on event date	$	NA
43. Critical CV Procedures	date of first	# on event date	$	NA
44. CV Surgery	date of first	# on event date	$	NA
45. Rx for ACE inhibitor therapy	date of first	days supply	$	# rx in month
46. Rx for Loop diuretic therapy	date of first	days supply	$	# rx in month
47. Rx for other diuretic therapy	date of first	days supply	$	# rx in month
48. Rx for Digoxin therapy	date of first	days supply	$	# rx in month
49. Rx for Beta Blocker therapy	date of first	days supply	$	# rx in month
50. Rx for Ca Channel Blocker tx	date of first	days supply	$	# rx in month
51. Rx for other CV drug	date of first	days supply	$	# rx in month
52. Rx for Non-CV drug	date of first	days supply	$	# rx in month
53. Rx for Na/H2O drug	date of first	days supply	$	# rx in month

FIGURE 7B

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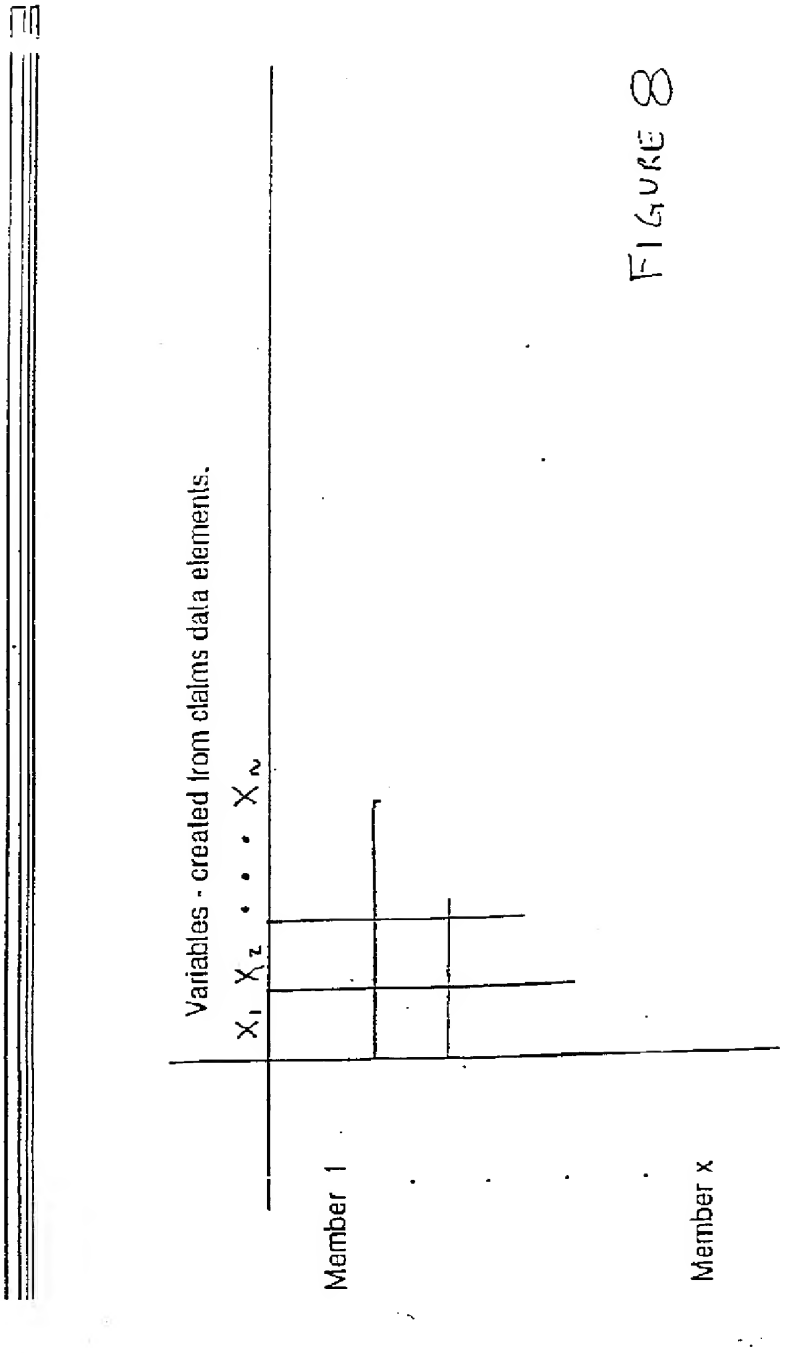

FIGURE 8

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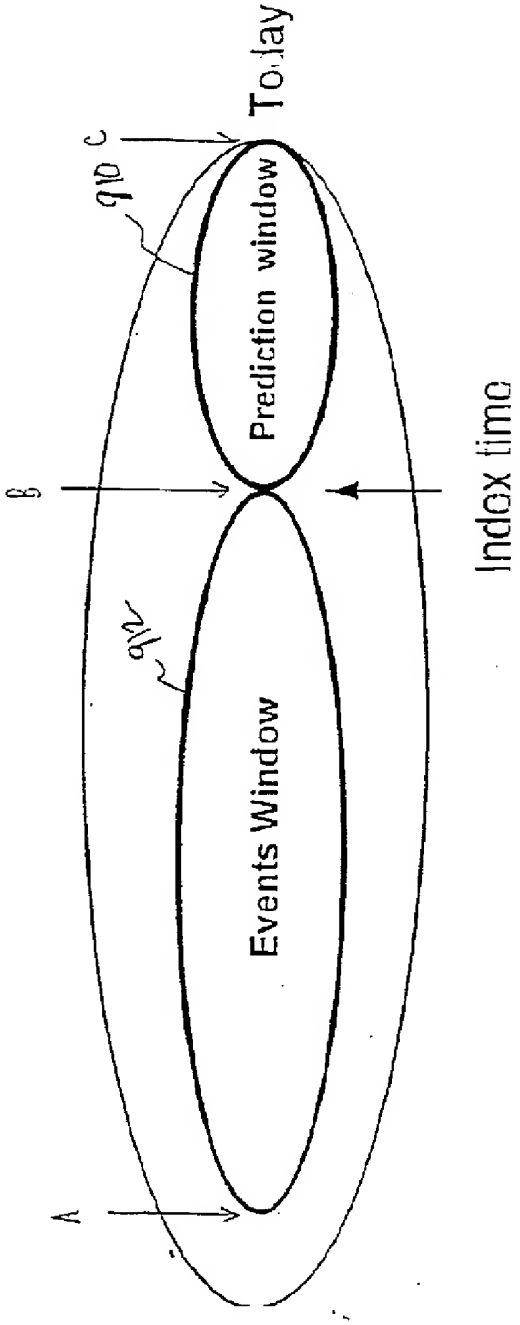

FIGURE 9

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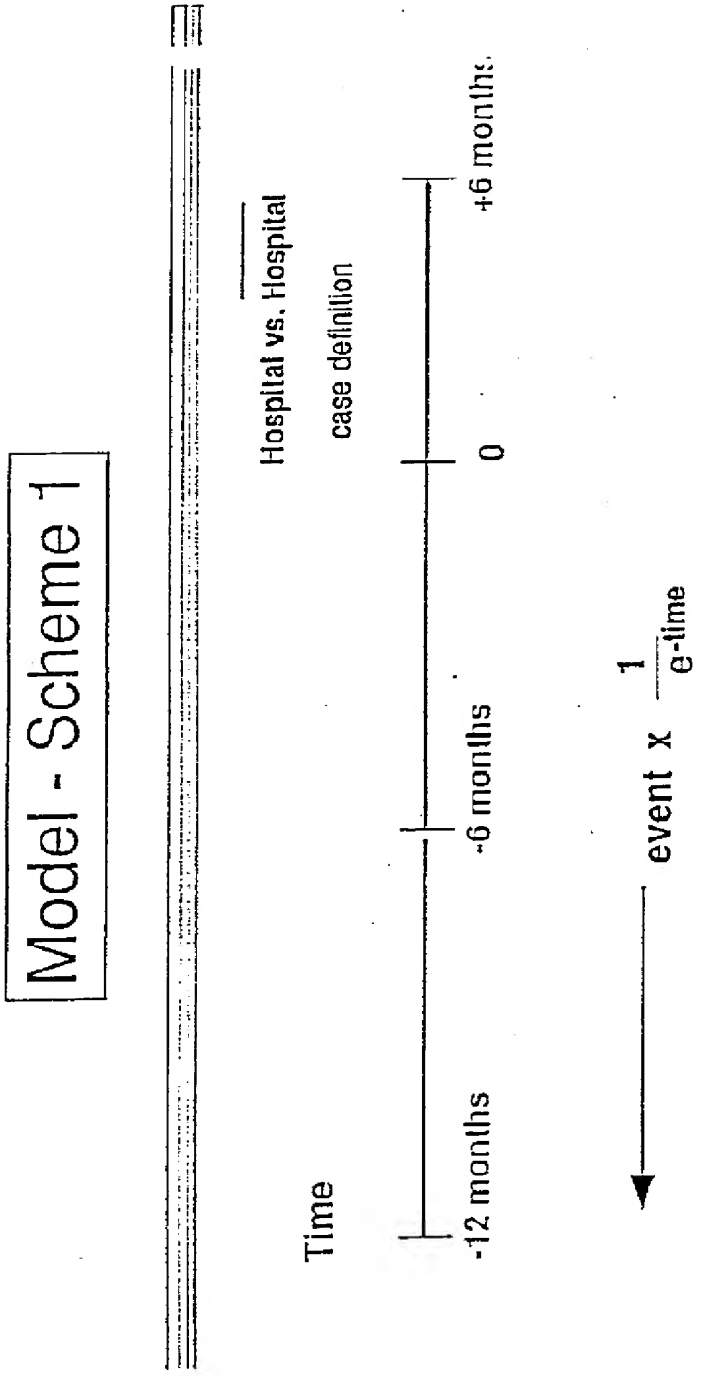

FIGURE 10A

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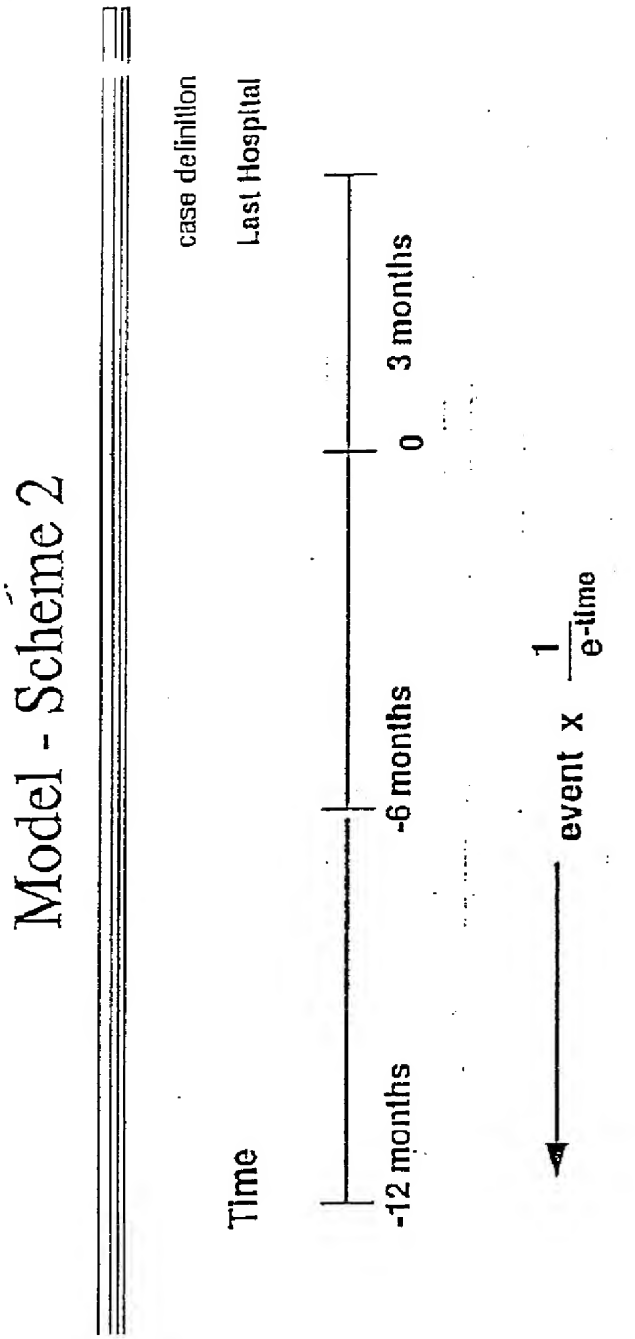

FIGURE 10B

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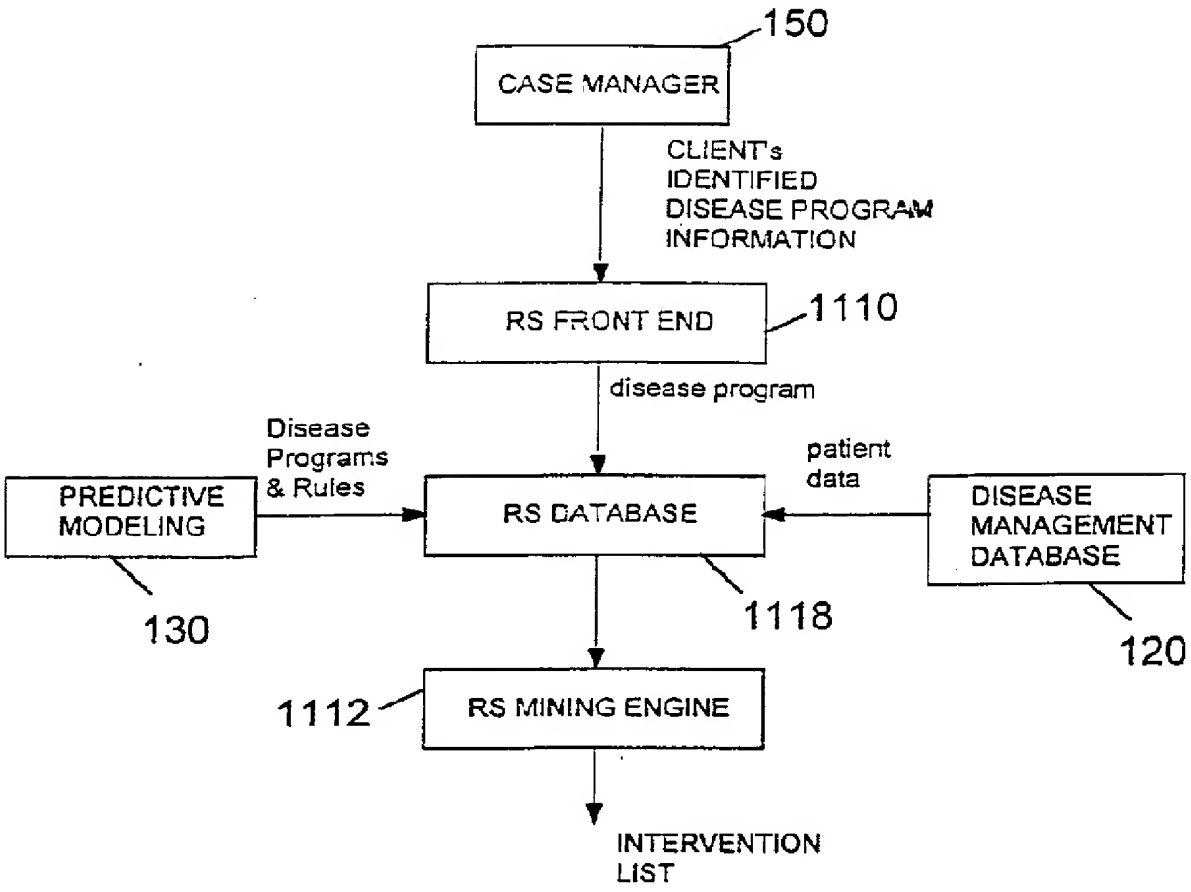

FIGURE 11

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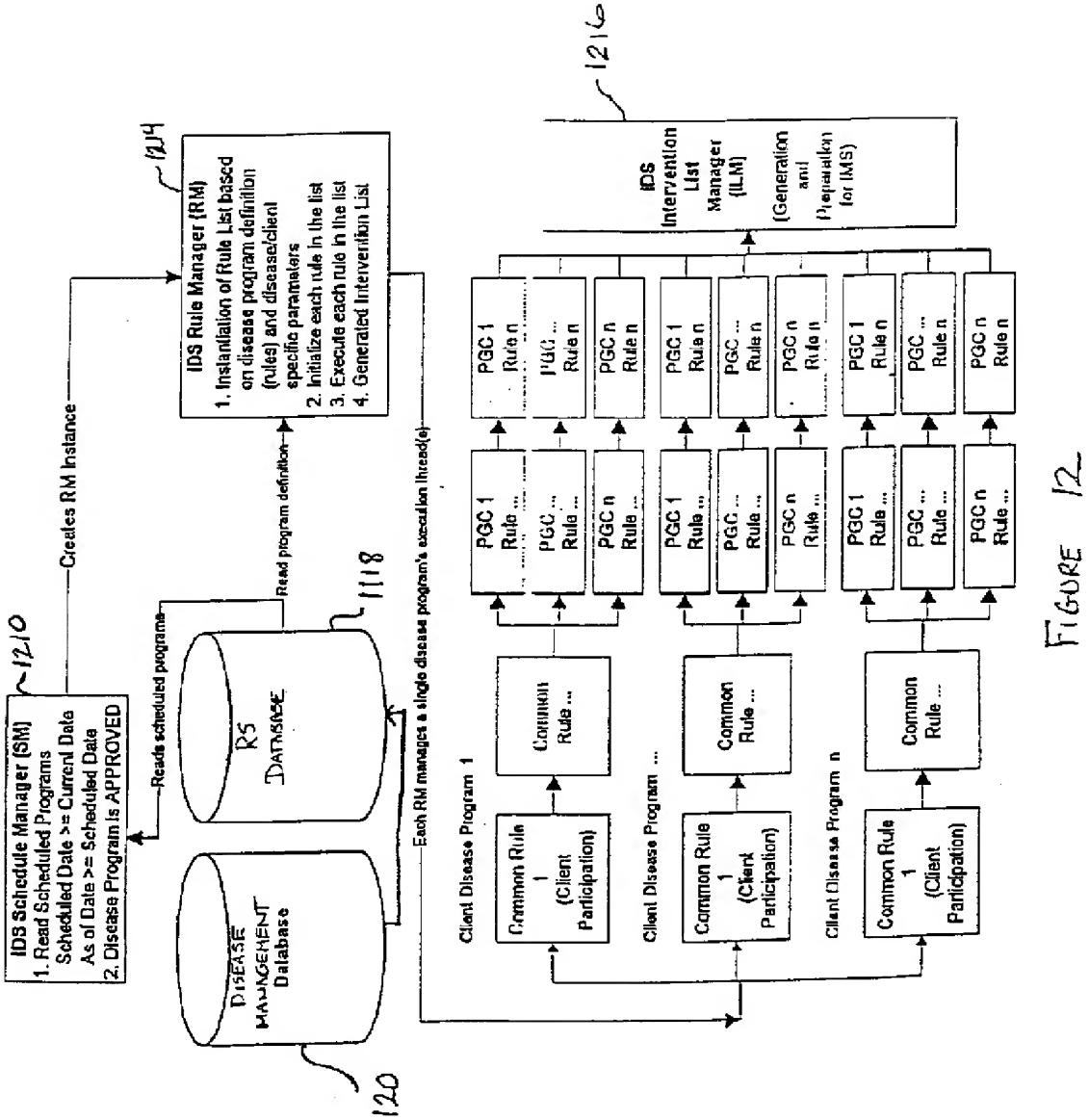

FIGURE 12

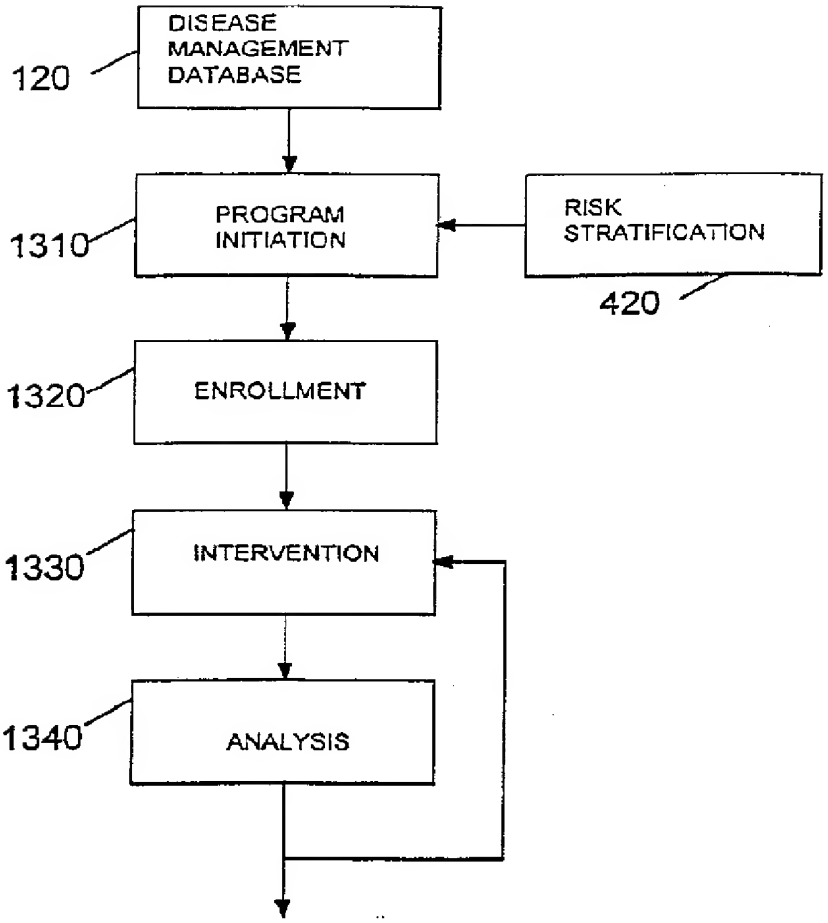
DISEASE
MANAGEMENT
DATABASE
120
PROGRAM
INITIATION
1310
RISK
STRATIFICATION
420
ENROLLMENT
1320
INTERVENTION
1330
ANALYSIS
1340

FIGURE 13

ABSTRACT

The Disease Management system and method includes a Patient Medical Information source 100, a Predictive Health Outcome Modeling process 102, a process for Intervention of At-risk Patients 103, and a source of disease management Modeling Guidelines 104. The Patient Medical Information source 101 is a database containing medical records of patients who participate in a healthcare provider's program. The Predictive Health Outcome Modeling process 102 produces a statistical model used to predict whether a patient with a particular disease is likely to suffer an adverse health outcome. The Intervention of At-risk Patients process 103 derives a list of at-risk patients who have a high risk of suffering an adverse health outcome and intervenes in the selected patient's healthcare treatment to decrease the possibility of such an adverse health outcome. The Predictive Health Outcome Modeling process 102 1) receives a sample group of patient medical data from the Patient Medical Information database 100 for a given disease, 2) receives pre-determined statistical information for generating predictive models, shown as the Modeling Guidelines 104, and 3) generates a particular predictive model for a particular disease to determine the probability of an adverse health outcome. The Intervention of At-risk Patients process 103 1) receives the predictive model provided by the Predictive Health Outcome Modeling process 102, 2) analyzes the individual patient specific medical data from the Patient Medical Information database 100, and 3) identifies a list of current patients that are at-risk of an adverse health outcome for a particular disease. The Intervention of At-risk Patients 103 process intervenes in the treatment process of the patients contained in the patient list through contact with the patient, physician, or healthcare provider, and the process requires externally generated information about treatment regimens for given stages of disease progression, as well as particular interventions.